Educational Investment of Youths: Empirical and Experimental Evidence

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Chapter 1

Introduction

> *The contempt of risk and the presumptuous hope of success are in no period of life more active than at the age at which young people choose their professions. How little the fear of misfortune is then capable of balancing the hope of good luck appears still more evidently in the readiness of the common people to enlist as soldiers, or to go to sea, than in the eagerness of those of better fashion to enter into what are called the liberal professions.*
> (Adam Smith: The Wealth of Nations, 1776)

Risk is a vital part of nearly every decision made by humans, and many essential educational decisions in life are made during youth and early adulthood, a period of life in which humans' decision-making abilities might not be as well-developed as later in life. Adolescents decide on their future occupations by choosing whether to go to university or not, which field of study to enter or which occupation to choose for apprenticeship training. Once they have entered training, they decide whether they want to graduate, to change into another field or another form of schooling, or drop out. They decide on whether and how much they want to drink, to smoke or to consume other drugs. All of these decisions have short-term consequences, such as the immediate gratification from alcohol consumption, but also the possible hangover on the next day. Dropping out from apprenticeship training might increase an individual's short-term utility by earning a higher wage

than an apprentice or by eliminating the stress of having to take exams. However, many of those choices during youth also translate into long-lasting impacts on their lives as adults - career opportunities, pay and employment prospects are largely determined by the field of study or occupation chosen during youth or early adulthood. Dropouts face higher unemployment risk and lack the requirements for many further education programs. Drug abuse during youth can be detrimental to educational success and translate into permanent damage to one's health.

In this Ph.D. thesis, I analyze educational investment decisions of adolescents and their determinants using empirical and experimental methods. While the second chapter explores individual- and regional-level determinants of educational investments, the third chapter assesses the impact of potentially harmful health behavior during youth on both educational and labor market success later in life. The fourth chapter provides an assessment of the impact of experimentally elicited time and risk preference, ability and personality traits on an individual's sureness to graduate as the result of a decision-making process for an educational investment and on their probabilities of smoking and drinking as the result of a decision-making process for a health investment.

Human capital theory as pioneered by Gary Becker (1962) and an extension by James Heckman (2007) provide the theoretical framework for the analysis. It predicts that a rational agent will invest in education (as in any other asset) only if it yields a positive net present value (NPV). Future costs and earnings streams can be discounted in order to make different alternatives comparable and to identify the optimal one. For several available choices, an individual will pick the one that yields the highest net present value. It also predicts that, ceteris paribus, educational investment will increase with higher expected benefits, lower expected costs, and lower rates of time preference, i.e. if future returns are discounted less. Heckman's (2007) model proposed a synthesis of the two distinct literatures on health and education economics and developed a lifetime model of investment in human capital. In his model, altruistic parents invest into their offspring's capabilities (i.e. cognitive and non-cognitive skills, and health). The model features characteristics that

capture insights from neurological and medical research on the development of human capabilities. Heckman's model allows the identification of critical and sensible periods for the development of human capabilities. This idea suggests that a developmental period can be seen as a critical period if a disinvestment in this period leads to lower probabilities of reaching a certain educational outcome later in life.

In the second chapter of this thesis, I analyze revisions of educational decisions in dual apprenticeship training. Unlike in previous economic research, I do not only focus on dropouts, but also on other choices after the termination of an apprenticeship contract. Building on previous research by Neuenschwander (1998, 1999) and Neuenschwander et al. (1996), I distinguish between three different educational choices: dropping out, changing (into another occupation) and upgrading (going back to general schooling or entering university). I carried out the empirical analysis using a German data set that was collected by the German Federal Institute for Vocational Education and Training (Bundesamt für Berufsbildung).[1] As the data set contains only youths who have dissolved their apprenticeship contracts, I use those whose contracts were terminated due to bankruptcy of their training firm as a control group. In a competing risks specification of a hazard rate model, I find that financial reasons, for example the opportunity costs of apprenticeship training or financial distress, seem to be the main determinants of the dropout decision. Also, local labor market conditions seem to be decisive determinants of individuals' decisions: hazards of staying within the educational system are significantly lower in regions with high unemployment rates. Another important finding is the result that the three different choices are driven by different determinants, suggesting that it is important to distinguish between them instead of focusing solely on the dropout decision. For example, financial distress during apprenticeship training leads to significantly higher hazards of dropping out and to significantly lower hazards of changing. These results show the importance of both monetary and non-monetary costs for human capital investment decisions. Human capital theory predicts that investment in human capital should, *ceteris paribus*,

[1] I thank Klaus Schöngen for providing me with this data set.

decrease with its costs, and I find indeed evidence that individuals decide to invest less in education when the associated costs are higher. In addition, lower expected labor market benefits should decrease educational investments. Again, I find empirical evidence supporting this prediction of human capital theory: adolescents in local labor markets with high unemployment rates are significantly less likely to stay within the educational system and finish their educational investment.

In the third chapter, I analyze the impact of onset of marijuana use during different periods in youth on educational outcomes and labor market success using a Swiss data set, the Swiss Health Survey (Schweizerische Gesundheitsbefragung). While previous research tries in most cases to analyze the impact of a risky behavior at any point in time on educational outcomes, I explicitly focus on different time periods of onset of marijuana consumption and their respective impact on educational and labor market success of the individual. Borrowing the idea of critical periods for human development from Heckman (2007), this approach allows to test whether there are different effects for different ages of onset and whether there are phases during youth when the onset of marijuana consumption is especially harmful for educational and labor market outcomes, meaning that they are indeed critical periods. Additionally, I measure educational success as having finished at least a secondary-level or a tertiary-level education instead of analyzing the impact of risky behavior on years of schooling as there is considerable evidence on "sheepskin effects" in education: there are very large increases in returns to schooling after the completion of numbers of years that usually correspond to the completion of a degree (Hungerford and Solon 1987), suggesting that degrees have an additional signalling value on the labor market. In order to take into account the possible endogeneity of educational decisions and the decision to consume marijuana, I estimate a multivariate probit model with a novel instrumental variable, using the local number of drug-related offenses as a supply-side instrument. Here, the results suggest that onset of marijuana consumption under age 14 leads to a significantly lower probability of having at least a secondary education, and onset of consumption before age 16 leads to a significantly higher probability of being

unemployed, even after controlling for educational attainment. Early adolescence (i.e. before age 14) seems to be a critical developmental period for the educational outcome of having at least a secondary education. The results for employment status suggest that onset of marijuana consumption before age 16 is a critical period for the development of personality traits that matter for employment. Early initiation into marijuana use does not only seem to be harmful for abilities that are essential for educational success, but also for skills that matter for labor market success. It could be the case, for example, that early marijuana consumption negatively affects personality traits such as grit and conscientiousness, which matter for success in the labor market in addition to educational qualifications. Hence, I find evidence for the existence of critical periods when analyzing the impact of early marijuana initiation on the development of human capabilities, meaning that early marijuana use is indeed a disinvestment in human capital and providing empirical support for the predictions of Heckman's model.

Finally, the fourth chapter presents first results from a field experiment that was designed in joint work with Holger Herz and Michael Kosfeld. Here, I analyze the impact of cognitive ability, personality traits and economic preference parameters on human capital investment-related decision-making ability of youths in apprenticeship training. The outcomes that I analyze here are adolescents' sureness to graduate from apprenticeship training, the probability of smoking and of binge drinking, and these choices are seen as the result of individuals' decision-making ability. With respect to cognitive ability and personality traits, I hypothesize that individuals with higher cognitive ability, higher cognitive reflection, a higher level of conscientiousness and a higher level of grit should have superior decision-making abilities because they should be more able to gather relevant information about choice alternatives and to assess these alternatives and their probabilities. With respect to economic preference parameters, I hypothesize that more patient and more risk averse individuals should be more determined to graduate and less likely to engage in risky behavior because they should be willing to invest more time in decision-making processes and be more affected by a higher variance in outcomes. These superior abilities should result in a

stronger determination to graduate and a lower probability of engaging in risky behavior. In order to test these hypotheses, we sampled from a cohort of incoming apprentices in several vocational schools in the canton of Zurich and elicited subjects' risk and time preferences using standard methods in experimental economics. In addition, subjects also answered two scales from psychological research on personality traits: the Big Five - 15 item short version used in the German Socio-Economic Panel (Gerlitz and Schupp 2005) and the Grit score (Duckworth et al. 2007), took a subsection from an IQ test and the Cognitive Reflection Test (Frederick 2005). I find that some personality traits and economic preference parameters seem to matter for the decision-making processes that lead to sureness to graduate, the probability to smoke and to drink. Grittier and more emotionally stable adolescents are more confident about their graduation probability. Risk-averse individuals are less likely to smoke, and more conscientious individuals are less likely to binge. These remarkable differences might be due to the fact that the decision for an apprenticeship training and the decision to smoke or to binge are typically taken in completely different social settings and with different planning time horizons. While the decision for apprenticeship training is typically the result of a long-term process that takes place with counseling and guidance from teachers, parents and career counselors, the decision to smoke or to binge is typically the result of a spontaneous decision that takes place among peers, possibly involving social pressure. Even if the same personality traits or abilities matter for the decision, their relative importance might be different in those different settings, and this might explain why different characteristics determine the three different choices.

The fifth chapter summarizes the main findings and the resulting contributions to research in the field that this thesis has made, broaches the issue of open questions and sketches ideas for further research.

Chapter 2

Dropping out and revising educational decisions: Evidence from apprenticeship training

(ISU Economics of Education Working Paper Nr. 40, submitted)

2.1 Introduction

The determinants and consequences of high school dropout behavior have received considerable attention from researchers in the past. An extensive literature examines the long-term development of dropout rates (Heckman and LaFontaine 2007), possible determinants of the decision to drop out of high school (Card and Lemieux 2000), and its long-term consequences (Oreopoulos 2007). Much less attention has been paid to the possibility that youths may *revise* an educational decision in different directions. Basically, there are three different possibilities: they can change to another schooling choice, they can go to a more challenging educational choice or they can drop out from the educational system and either work as unskilled workers or end up unemployed.[1] We call the different choices *changing*, *upgrading* and *dropping out*, respectively.

While the first two groups (changers and upgraders) are rather unproblem-

[1]This is a simplified approach, which is nevertheless based on previous work, e.g. by Neuenschwander (1998, 1999) and Neuenschwander et al. (1996).

atic with respect to long-term labor market consequences of their decisions, the last group (dropouts) runs higher risks. Increasing qualification requirements and technical progress give dismal prospects to the unskilled and low-skilled labor force. Additionally, integration into the global economy leads to a lowered demand for unskilled labor (Wissenschaftlicher Beirat des Bundesministeriums für Wirtschaft und Technologie 2006). Empirical studies for the UK and the USA (e.g., Fabbri et al. 2003) seem to suggest that openness increases the elasticity of labor demand, probably especially for low-skilled labor.[2] Besides, wages for unskilled workers are considerably lower. Another risk for educational dropouts is the fact that they lack the requirements for many further education programs. In fact, Oreopoulos (2007) finds that the welfare loss from dropping out from compulsory school is large and probably not outweighed by gains from the dropout decision such as being able to enter the labor market earlier. Hence, there should be a pronounced interest in understanding the reasons why youths drop out of education as opposed to other educational revisions.

For our empirical analysis of the decision to revise an educational choice, we use a German data set on revisions of the decision to enter apprenticeship training. The advantage of this data set is that the different choices can be very clearly distinguished, instead of focusing solely on dropouts as one educational revision. We further add to the existing literature by taking into account various non-financial costs of apprenticeship training as an investment in human capital, as well as financial opportunity costs and perceived bad prospects after finishing the apprenticeship training. This relates to recent work by Dynarski (2008) who finds that scholarship programs lowering the costs of a college degree significantly decrease college dropout rates. Also, Maurin and Xenogiani (2007) find that higher benefits of education (in their

[2]There are two possible reasons for this phenomenon: more trade leads to more competitive goods markets, and multinational firms' global production networks enable them to shift their production abroad more easily. The results are higher unemployment rates on less flexible labor markets (as the German one) for low-skilled workers. It seems that more flexible labor markets tend to end up with higher inequality in labor incomes. Barba Navaretti et al. (2003) use European panel data and also find that in a given country, foreign-owned enterprises adjust their employment systematically faster than domestic ones.

case, the possibility to avoid military service for males) led to lower dropout rates from high school. In addition, our data set contains questions why the individuals dropped out of their training.

For the empirical analysis, we use two different types of duration analyses, namely, a simple hazard rate estimation and a competing risks model. In the simple hazard rate estimation, we analyze the decision to drop out of apprenticeship training as compared to staying within the educational system (i.e. upgrading or changing) because dropping out can be seen as the riskiest educational choice. We find a high importance of monetary reasons to drop out. The higher the apprenticeship wage is relative to the wage for unskilled workers, the lower is the hazard of dropping out. Also, bad income prospects and financial distress lead to significantly higher hazards of dropping out. Finally, we confirm results from earlier studies that individuals with a higher previous level of schooling have significantly lower hazards of dropping out.

In the competing risks model, we use the fact that there are apprentices in the sample whose contract was terminated because of a bankruptcy of their firm and assume that they would have completed their apprenticeship successfully without this event. Here, we analyze the decisions to enter the three different educational choices of dropping out, upgrading and changing. While the results for the financial impact factors are confirmed, we find in addition that several regional-level variables significantly affect these decisions. More favorable conditions on the local labor market for apprentices (i.e. more places available per seeker) lead to a signficantly higher hazard of changing. Also, a higher local unemployment rate leads to significantly lower hazards of changing and upgrading. These results confirm earlier findings on the importance of local labor market conditions for educational choices. However, the most stable and probably most important result is the importance of financial reasons for an individual's decision to drop out, which is confirmed in all specifications.

The remainder of our paper is organized as follows. Part 2.2 provides a brief literature review. Part 2.3 presents theoretical considerations and the estimation framework for our empirical analysis. Part 2.4 gives some background information on the main institutional features of the German educational

system with a special emphasis on apprenticeship training, introduces the data set that we used and provides descriptive statistics. Part 2.5 presents and discusses our estimation results, while part 2.6 concludes and sketches an agenda for future research on the topic.

2.2 Literature

There is quite a substantive body of research on high school dropouts in the United States, but considerably less on revisions of educational choices. However, we think that the findings from the US studies on high school dropouts are relevant for our paper as well because they focus on the riskiest educational choice. Whenever there is evidence from research on dropouts from apprenticeship training, we discuss it briefly as well. The existing evidence on dropout determinants has focused (inter alia) on personal characteristics, risky behavior, family background, peer effects and regional labor markets, but only rarely on costs and benefits.

The studies typically find that more able individuals are less likely to drop out (see, for instance, Bishop and Mane 2001 for the United States or Bradley and Lenton 2007 for the United Kingdom). The same seems to be true for apprentices where all studies report that youths with a higher level of previous schooling are less likely to drop out (see, for example, Alda 2003). There could be two main reasons for the importance of schooling: on the one hand, longer schooling should be associated with more ability and hence lead to less schooling problems, which can subsequently lead to the decision to quit the training because of high non-monetary costs. On the other hand, more schooling seems to lead to better decision-making abilities (Cutler and Lleras-Muney 2006), so individuals with more schooling probably make better educational decisions, resulting in less matching problems and consequent dropout decisions. Additionally, youths with more prior schooling have in general a larger set of choices available, so they are probably less often forced to start an apprenticeship just because it was the only offer that they received. This could also lead to better matches and less resulting dropouts.

In general, the studies from the United States and the United Kingdom find important differences in behavior with respect to ethnicity. While they find that members of minorities are less likely to drop out, the results are the opposite for apprenticeship training in the German-speaking countries. Blacks and hispanics are found to have a higher probability of high school graduation (Nguyen et al. 2006), and members of ethnic minorities are also found less likely to drop out of post-secondary education in the UK (Bradley and Lenton 2007). However, members of ethnic minorities seem to fare worse than natives in the apprenticeship training system of the German-speaking countries. Neuenschwander (1999) finds in a descriptive study that apprentices without native citizenship are more likely to drop out, Stalder and Schmid (2006) find that natives are significantly more likely to continue their education, and Schöngen (2003) reports that fewer ex-apprentices with foreign parents are still planning to continue their education.

The literature on high school dropouts has in most cases not focused on the timing of the dropout decisions. For the apprenticeship dropouts, previous research has established that most terminations take place during an early stage of the training, and this also seems to be an indicator for matching problems: many youths say that they did not have enough information about their training firm (Stalder and Schmid 2006).

A bad working atmosphere, especially clashes with the instructor and/or colleagues rank among the most frequently cited reasons for a termination on firm level (Schöngen 2003, Neuenschwander et al. 1996, Stalder and Schmid 2006). This provides evidence for matching-related problems: apprentices want to change to another firm (but not necessarily to another occupation) if the perceived costs of training are lower in another firm, hence, in a better match.

The regional labor market is another possible impact factor on educational decisions. Card and Lemieux (2000) find that higher regional unemployment rates lead to a rise in high school completion rates. Also, Neuenschwander (1999) finds that there are many dropouts in fields where there are abundant employment opportunities for unskilled workers. The short-term financial gains of finding an alternative employment seem to lead the apprentices to

not taking into account long-term implications of their decision. This can be seen as a hint towards the importance of time preference in education-related decision making, a hypothesis that we are going to test in the third essay. Also, this finding underlines the importance of economic incentives that can have adverse impacts on educational outcomes.
Revisions of educational decisions are a complex phenomenon and one reason for the partly contradictory results presented here could be the fact that these studies have only focused on dropping out as one educational revision. However, the importance of decision-making abilities, resulting matching problems and economic incentives, for example adverse local labor market conditions, seems to be confirmed by all the presented results.
In the following section, we provide theoretical considerations for the different choices of changing, upgrading and dropping out that we identified earlier on, and we derive testable hypotheses.

2.3 Estimation Framework

2.3.1 Theoretical Considerations

The economic theory of human capital as pioneered by Becker (1962) predicts that a rational agent will invest in education (as in any other asset) only if it yields a positive net present value (NPV). Future costs and earnings streams can be discounted in order to make different alternatives comparable and to identify the optimal one. For several available choices, an individual will pick the one that yields the highest net present value.
As we analyze the decision to revise educational choices, we have to slightly adjust this framework and incorporate learning about job or occupation characteristics into the decision framework. A characteristic of educational decisions is that decisionmakers typically have only incomplete information about costs and benefits related to their choice. Apprentices will revise an educational choice after learning more about its characteristics if the updated expected utility flows outside this choice exceed the updated expectations of their current choices plus the costs of changing. A choice that may initially

have seemed profitable might, *ceteris paribus*, become unprofitable from an individual's point of view because of higher than initially expected costs or lower than expected benefits. Examples for costs of an apprenticeship training include learning costs or exam nerves, the opportunity costs of an apprenticeship training as measured by the relative wage of apprentices as compared to the relative wage for unskilled workers, and being a female in a predominantly male occupation as well as being a male in a predominantly female occupation because lacking peers of the same gender might cause adolescents disutility. In order to analyze revisions of educational decisions, one would ideally need information about the changes in relative apprenticeship wages between the time when the individual made his or her initial educational decision and the time when he or she revised this decision ($\frac{\Delta apprenticeshipwage}{\Delta unskilledwage}$). Similarly, one would need information on changes in unemployment rates between those two points in time. However, we do not know when the individual made his or her educational decision. Most apprentices take this decision at some point in time during the last year of school, but while some might decide even earlier, others might decide only very shortly before their apprenticeship training starts. Lacking information about the time of decision-making about their educational career, we can only use information about the point in time when the apprentices decided to revise their decision, because this is the only information that we have. We have to assume that relative wages and unemployment rates have changed over time in such a way that it is, suggesting that is rational for the apprentices to revise their educational choice to another possibility. To put it more clearly, both variables have to change in such a way that dropping out and working as an unskilled worker or changing to another occupation or going back to general schooling has to be more favorable than staying in the original apprenticeship training. For both variables, changes over the one-year-span are quite substantial, but unfortunately, we do not know neither about the relevant time span for a change to take place (i.e., the time elapsed between initial decision-making and changing decision) nor about the direction and therefore, we have to maintain this assumption. this assumption does not seem too strong. See the following two graphs for changes in real

wages and for changes in unemployment rates compared to the same quarter in the previous year. Even if some of this information might be available *ex ante*, adolescents might not fully realize the costs and benefits until they start their apprenticeship training. Forming expectations about the costs or benefits and actually experiencing them might lead to different decisions. An example is theoretically knowing about the apprenticeship wage and actually having to "make do" with it which might lead adolescents to reconsider their initial decision because they have not realized how much (or few) they will actually earn as a wage. Also, meeting unskilled workers at the job and realizing that they earn much more than an apprentice for carrying out similar tasks might lead an apprentice to revise his or her initial decision.

As dropping out is the riskiest educational choice after dissolution of an apprenticeship contract, we first analyze the decision to drop out as opposed to staying within the educational system (i.e., changing or upgrading). While changers and upgraders should expect to realize a positive net present value from their investment, we expect cost-related impact factors to be important for the dropout decision. Ceteris paribus, we expect that individuals with financial distress and exam nerves should be more likely to drop out. Financial distress creates incentives to drop out, work as an unskilled worker and earn a higher wage in the short run. Exam nerves are a form of psychological costs of an apprenticeship training, and we expect that individuals with exam nerves are more likely to drop out as opposed to staying within the educational system and having to take further exams. We also expect that individuals with higher previous levels of schooling have lower costs of learning and that they should therefore be less likely to drop out as opposed to staying within the educational system. Finally, we expect some local labor market characteristics to matter for the decision to drop out as opposed to staying within the educational system. Specifically, we expect that the benefits of completing apprenticeship or another form of eduation should be lower in thinner local labor markets. Hence, we expect higher hazards of dropping out as opposed to staying in the educational systems in local labor markets with higher unemployment rates, less availability of public transport, and higher population density. Finally, we expect some characteristics of the

apprenticeship labor market to matter for the dropout vs. staying in the educational system decision. In apprenticeship labor markets with a higher supply-demand ratio (i.e. more available places per 100 seekers), we expect changes to take place more easily and hence lower hazards of dropping out as opposed to staying. Lastly, a higher percentage of youths in out-of-firm training among all youths in apprenticeship training is also a proxy for a difficult apprenticeship labor market. We expect higher hazards of dropping out in labor markets with higher percentages of youths in out-of-firm training.

In the second part of the empirical analysis, we carry out a competing risks analysis, using a control group of apprentices whose apprenticeship contract was dissolved due to bankruptcy of their training firm. We assume that these apprentices would have graduated from apprenticeship training without the bankruptcy and hence analyze the three different choices as opposed to graduating from apprenticeship training. We expect different impact factors for the different choices as compared to the analysis before because we now use a control group of assumedly successful graduates, and not of individuals who changed to another educational path, but stayed within the educational system.

Wheeler (2001) shows in a matching model that thicker labor markets lead to better matching between workers and firms due to lower search costs. This leads to higher productivity, higher inequality (in pay between different skill groups) and higher expected returns to skill. Hence, apprentices in thicker labor markets should have more incentives to complete their training, *ceteris paribus*, than their counterparts in areas where the labor market conditions are less favorable. We therefore expect higher hazards of dropping out in regions with a thin local labor market.

With respect to the local labor market for apprenticeship training, we expect higher hazards of dropping out as opposed to graduating from apprenticeship training in thinner local apprenticeship markets. Even if the apprentices might want to change to another apprenticeship, they might have problems to find another place in thin markets. Using a similar argument, we expect higher hazards of changing to another firm or occupation in thick local labor

markets because it is easier to find a new place in a more favorable labor market for apprentices. Lastly, we do not expect any impact of local apprenticeship labor market conditions on the decision to upgrade as opposed to graduate.

With respect to the previous level of schooling, we expect individuals with more education to have lower hazards to drop out as opposed to graduate from apprenticeship training and to have higher hazards to upgrade as opposed to graduate. Those with more previous education should, *ceteris paribus*, incur lower learning costs and therefore have lower dropout hazards. They should also have higher hazards of upgrading their educational choice, also because only the holders of an *Abitur* or *Fachabitur* are allowed to enroll in universities or universities of applied sciences (*Fachhochschulen*). We do not expect any impact of the previous level of schooling on the hazards of changing as opposed to graduating from apprenticeship training.

For the upgraders, we expect a high importance of bad prospects as a reason to revise their educational decision. When they realize during their apprenticeship training that their chosen occupation has bad career prospects or bad income prospects, they should have incentives to upgrade their education in order to get a higher level of education and resulting better career and income prospects instead of staying in the same occupation and graduate in the first occupation that they have chosen. Similarly, the changers should have realized that the NPV of their educational investment is positive, but that they can do even better in another occupation. So, we also expect a high importance of bad prospects for the decision to change to another occupation as opposed to graduate from apprenticeship training in the first occupation. For the dropouts as the last educational revision possibility, the NPV of their investment should not be positive, either because of the fact that their costs are too high or their benefits are too low. This is why we expect general cost-and benefit-related impact factors (e.g. exam nerves, financial distress) to be important for the decision to drop out of apprenticeship training as opposed to graduate from it. We do not expect any impact of these two cost measures on the hazards of upgrading or changing as opposed to graduating from apprenticeship training.

Incorporating the idea of learning and updating expectations also leads to the prediction that the hazard rates from a started apprenticeship to any destination will probably fluctuate with duration in a non-monotonic way. During the initial learning period, apprentices (and firms) learn about the quality of the match and will probably only remain in a satisfactory match (cf. Jovanovic 1979 for matching on the labor market). As only these satisfactory matches survive, the number of revisions will probably decrease after the initial learning period, leading to lower hazards later during the apprenticeship. At the same time, the time period until the first returns from the apprenticeship will be realized decreases and the time period in which costs of the apprenticeship occur decreases. This should also lead to lower hazards of going to any other educational choice later during apprenticeship training.

2.3.2 Methods

The structure and available information of the data set offer the possibility to carry out different types of analyses. As we are interested in the timing of the decision to quit an already started apprenticeship training, we estimated various survival analysis models.

Simple Hazard Rates

We started our analysis with a simple hazard analysis of the decision to switch to a different choice within the educational system (i.e., to change or to upgrade) vs. dropping out of it. The information on the timing of the decision to quit the apprenticeship training is available in discrete time (i.e., during probation, later in the first year, in the second, third, and fourth year). Hence, we have grouped data and use a complementary log-log specification for estimation.

Following Prentice and Gloeckler (1978), we specify the discrete time hazard as

$$h(x,t) = 1 - exp[-exp(x'_{ij}\beta + \phi(t))] \tag{2.1}$$

where $\phi(t)$ describes how the duration of the spell affects the hazard rate. We worked with a fully non-parametric specification of the hazard function. In order to deal with unobserved heterogeneity (also referred to as "frailty"

in the duration analysis literature), we worked with two different approaches. The first one was a parametric specification, using a Gamma-distributed individual heterogeneity term. We chose a Gamma distribution because Abbring and van den Berg (2007) have shown that for exponential mixtures, the distribution of heterogeneity among survivors converges rapidly to a Gamma distribution. However, a test of the null hypothesis that the unobserved heterogeneity variance component is equal to zero could not be rejected. The second approach was a non-parametric specification following the approach by Heckman and Singer (1984). In this model, where we modeled the non-parametric unobserved heterogeneity using two mass points, we could not reject the null hypothesis that the mass point for type 2 is statistically no different to the mass point for type 1. Hence, we present only the results that do not take into account unobserved individual heterogeneity.[3]

Competing Risks Model

In order to estimate a discrete-time competing risks model, we need to make assumptions about the shape of the hazard rate within each time interval because this shape cannot be identified from the data at hand. The literature up to now has worked with several different approaches, either dealing with assumptions on the timing of transitions (see Narendrenathan and Stewart 1993) or with assumptions on destination-specific densities or hazard rates (see, for example, Dolton and van der Klaauw 1999). We assume constant within-interval destination-specific hazard rates (an approach used by Roed and Zhang 2005) and use the fact that the likelihood function for small interval hazards in this case approaches a much simpler likelihood for the estimation. The likelihood is then given by

$$L = (L^A)^{\delta^A}(L^B)^{\delta^B}(L^C)^{\delta^C}(L^D)^{1-\delta^A-\delta^B-\delta^C} \tag{2.2}$$

[3]It should also be kept in mind that these frailty models are also "frail" in a statistical sense, meaning that the introduction of a possibly misspecified term that aims at capturing unobserved heterogeneity can lead to even more serious distortions than ignoring it (see, for example, Arulampalam and Stewart 1995 or Narendranathan and Stewart 1993).

where the δ's denote destination-specific censoring indicators and the L's denote the destination-specific likelihood contributions. Following Allison (1982), we assume a particular functional form for the destination-specific hazards and get the following likelihood contribution for an individual with spell length j:

$$
\begin{aligned}
L = & \left[\frac{\exp(\beta_A' X)}{1+\exp(\beta_A' X)+\exp(\beta_B' X+\exp(\beta_C' X)}\right]^{\delta^A} \times \\
& \left[\frac{\exp(\beta_B' X)}{1+\exp(\beta_A' X)+\exp(\beta_B' X+\exp(\beta_C' X)}\right]^{\delta^B} \times \\
& \left[\frac{\exp(\beta_C' X)}{1+\exp(\beta_A' X)+\exp(\beta_B' X+\exp(\beta_C' X)}\right]^{\delta^C} \times \\
& \left[\frac{1}{1+\exp(\beta_A' X)+\exp(\beta_B' X+\exp(\beta_C' X)}\right]^{(1-\delta^A-\delta^B-\delta^C)} \times \\
& \prod_{k=1}^{j-1}\left[\frac{1}{1+\exp(\beta_A' X)+\exp(\beta_B' X)+\exp(\beta_C' X)}\right] \qquad (2.3)
\end{aligned}
$$

This is the same likelihood as the one for a multinomial logit model and can be estimated with re-organized data (Jenkins 1995). We used the fact that there is quite a substantial number of apprentices whose contract was terminated due to bankruptcy of their training firm. This enables us to treat them as a control group, assuming that they would not have terminated their apprenticeship without the bankruptcy.

The next section presents background information, our data sources and some descriptive statistics.

2.4 Background and Data

Our empirical analysis of dropout and changing behavior of apprentices is based on a survey of the German Federal Institute for Vocational Education

(Bundesinstitut für Berufsbildung) in 2002.[4] Its main advantage is that it allows us to distinguish the three different possible revision decisions very clearly. In addition, it contains extensive information on the reasons for the youths' decision to terminate their apprenticeship. There are several questions that allow us to analyze possible impact factors that have never been used in previous research on the topic, such as the importance of exam nerves or financial distress.
Further questions include information on the current status of the former apprentices, on their educational background, on the year in which they terminated their contract, on respondents' gender and if they have non-native parents. The data set also includes information on the regional provenance of respondents that enabled us to add statistical information from Germany's regional statistics and from the federal employment agency's statistics on the regions of origin.

2.4.1 Institutions

Firm-provided apprenticeship training is still one of the most important ways of entering the labour market for youths in the German-speaking countries (Ryan 2001). In Germany, for example, 58% of all school leavers started an apprenticeship in 2005, and about 20% of those youths decided not to complete their apprenticeship, but decided to revise their educational choice.
After their school graduation, the youths in Germany who want to continue their education can either study at universities or polytechnics (*Fachhochschulen*) if they hold the necessary qualification, enter dual apprentice-

[4] 9000 questionnaires were sent out to youths who had dissolved their apprenticeship contract in 2001/2002. 2323 questionnaires were returned, but only a smaller number could be used for this work, e.g. because vital information was missing. As the focus of this research is on revision decisions, we also excluded the youths whose apprenticeship contract was terminated before they started their apprenticeship. There might be selection bias, if, for example, dropouts are less likely to answer such a quesionnaire. However, the descriptive numbers for dropouts as opposed to other educational choices after the dissolution of an apprenticeship contract are quite similar to previous studies in the field. See, for example, Neuenschwander 1996 and 1999.

ship training or go to full-time vocational schools (*Berufsfachschule*).[5] There is of course also the possibility to enter the labor market directly after school without apprenticeship training. In the short run, this can be an attractive option for the youths because the typical wage for an unskilled worker is considerably higher than for an apprentice. The following table shows average gross monthly wages for school graduates without apprenticeship training (in the secondary and tertiary sector) and for all apprentices in 2001, computed from data by the German Federal Statistical Office and the Federal Institute for Vocational Education and Training.

Table 2.1: Wages for apprentices and workers in 2001

	Blue collar workers		White collar workers
West Germany			
Hauptschule/Realschule graduate	2177		2655
Gymnasium graduate	2252		3456
Average apprenticeship wage		582	
East Germany			
Hauptschule/Realschule graduate	1599		2173
Gymnasium graduate	1834		2538
Average apprenticeship wage		497	

Sources: Federal Institute for Vocational Education and Training, Datenbank Ausbildungsverguetungen, downloaded from http://www.bibb.de/de/783.htm (apprenticeship wages), German Federal Statistical Office, Gehalts-und Lohnstrukturerherbung im Produzierenden Gewerbe und im Dienstleistungsbereich, downloaded from https://www-genesis.destatis.de/genesis/online;jsessionid=5C0B5B855E11BE9DE00D3CAB55313FA9.tcggen1?operation=statistikAbruftabellenlevelindex=0 levelid=1272895553045index=2 (gross monthly wages for school graduates without apprenticeship training)

The focus of this work is on revising educational decisions in *dual vocational training*. It consists of in-firm training at the workplace and classes at a vocational school (*Berufsschule*). At the moment, there are nearly 350 state-approved occupations for which apprenticeship training is available. They last between 2 and 3.5 years. The apprenticeships are of general nature because they finish with a recognized degree. Winkelmann (1996) and Korpi

[5]These schools exist, inter alia, for training in technical, health-related or business-related occupations. Some examples are chemical-technical assistants or nurses.

and Mertens (2003) both find evidence for the importance of general, transferable skills from an apprenticeship as compared to firm-specific human capital. Apprentices earn a small wage (see Table 2.1 for average numbers in 2001) paid by their training firms, and youths get their training place either on their own initiative or through the intermediation of the local employment agency or other institutions.

2.4.2 Descriptive Statistics

The following section presents some interesting descriptive features of the data set. We provide complete summary statistics in Appendix A.1.
Timing and educational choice after terminations of apprenticeship contracts are similar to previous studies. A majority of contracts was terminated during the first year of the apprenticeship (63%). Late terminations (3rd and 4th year) are quite uncommon. Nearly 80 % of all youths decided to continue their education, but one fifth decided to quit the educational system and work as unskilled workers or were unemployed.
A closer look reveals more interesting descriptive results: female teenagers drop out from the training system less often. This lower level is outweighed by a higher percentage of changers among the girls, while the level of upgraders is similar for both sexes.

Table 2.2: Choice by Gender

	Males	Females
Changer	71.86%	76.69%
Upgrader	6.44%	6.76%
Dropouts	21.70%	16.55%
n	931	858

Source: Survey "Vertragslösungen 2002 - Strukturen und Gründe" of the German Federal Institute for Vocational Education in 2002, own calculations

A well-known result shows up for the previous level of schooling:[6] the higher

[6]The German schooling system tracks pupil into three different schools after 4 or 6 years of primary school. The lower secondary school (*Hauptschule*) lasts 5 years while the middle secondary school (*Realschule*) lasts 6 years and the upper secondary school

it is, the lower is the youths' risk of dropping out of the schooling system. While 40% of teenagers without any school-leaving certificate dropped out, only 7% of the ones holding an Abitur did so. Inversely, they chose much more often to upgrade, probably also due to the fact that they are the only ones among the respondents who can enter university directly.

Table 2.3: Choice by prior level of schooling

	None	Hauptschule	Realschule	Fachabitur	Abitur
Changers	55.17%	71.69%	79.09%	78.72%	67.53%
Upgraders	3.45%	2.25%	6.46%	11.7%	26.62%
Dropouts	41.38%	26.06%	14.44%	9.57%	5.84%
n	58	756	727	94	154

Source: Survey "Vertragslösungen 2002 - Strukturen und Gründe" of the German Federal Institute for Vocational Education in 2002, own calculations

Finally, a look at the choice of terminating youths depending on the timing of their termination of contract shows that the early terminations seem to be less problematic than the late ones: while only 16% of the terminations during probation time led to a dropout, 37% of the terminations during the third year did so. This result is mirrored by the development of changing behavior, which decreases heavily for the later terminations. These later terminations of apprenticeship contracts seem to lead to more problems.

Table 2.4: Choice by Timing

	Probation	First year	Second year	Third year	Fourth year
Changers	74.39%	76.03%	77.13%	60.13%	40.00%
Upgraders	9.42%	7.39%	3.74%	2.61%	6.67%
Dropouts	16.20%	16.58%	19.13%	37.25%	53.33%
n	531	609	481	153	15

Source: Survey "Vertragslösungen 2002 - Strukturen und Gründe" of the German Federal Institute for Vocational Education in 2002, own calculations

(*Gymnasium*) lasts either 8 or 9 years and pupils graduate with an *Abitur*. The latter is the only type of school whose graduates are allowed to study at a university. However, there are also various possibilities to gain a Fachabitur (that allows its holders to study only in a certain field) or Fachhochschulreife (in order to study at a polytechnic) outside the Gymnasium.

As already mentioned, the data set contains information on the regional origin of respondents and allows to match regional-level information. Patterns of behavior across the regions vary remarkably, but neither according to the type of chamber (chamber of commerce vs. chamber of crafts) nor according to the location (east vs. west, north vs. south). The following table summarizes the inter-regional differences.

Table 2.5: Choice by Region of Origin

	Aachen	Augsburg	Darmstadt	Flensburg
Changers	73.05%	78.50%	61.36%	77.38%
Upgraders	5.39%	5.21%	11.36%	4.76%
Dropouts	21.56%	16.29%	27.27%	17.86%
n	167	307	44	168
	Frankfurt/O.	Freiburg	Gera	Karlsruhe
Changers	77.98%	77.84%	84.85%	76.64%
Upgraders	4.59%	11.98%	3.03%	6.54%
Dropouts	17.43%	10.18%	12.12%	16.82%
n	109	167	33	107
	Kiel	Krefeld	Leipzig	Osnabrueck
Changers	70.80%	59.78%	79.37%	78.02%
Upgraders	5.47%	12.85%	6.35%	2.2%
Dropouts	23.72%	27.37%	14.29%	19.78%
n	274	179	63	91
	Rostock	Entire Sample		
Changers	75.00%	74.18%		
Upgraders	3.75%	6.6%		
Dropouts	21.25%	19.23%		
n	80	1789		

Source: Survey "Vertragslösungen 2002 - Strukturen und Gründe" of the German Federal Institute for Vocational Education in 2002, own calculations

Dropout rates are highest in Darmstadt and Rostock, while they are lowest in Freiburg and Gera. The thickness of regional labor markets could provide an explanation for the different dropout rates. We will test this hypothesis in the empirical part of our paper.

2.4.3 Selection and Construction of Variables

Several questions in the questionnaire can be used as proxies for direct and indirect costs and benefits of educational choices in order to test our empirical implications. Three of the questions aim at capturing the perceived long-term benefits of an apprenticeship: they ask for the importance of bad employment prospects after the apprenticeship, bad income and bad career prospects, respectively. Exam nerves are a form of short-term indirect costs due to stress and perceived mental overstrain of school. Respondents were also asked directly for financial distress as a reason for termination of the apprenticeship contract. More than 30% of the ex-apprentices who named this reason were employed as unskilled workers, compared to only 12 % among those who did not have financial problems. This provides descriptive evidence for the possible importance of financial distress as a form of opportunity cost of an apprenticeship. We also included a measure for another form of non-monetary cost: being a girl in a male occupation or, vice versa, a boy in a female occupation that we measured as being trained in an occupation with on average more than 60% apprentices of the other gender. The higher cost could be due to the fact that youths without peers of the same sex are more often the victims of bullying at work (see, for instance, Litzcke 2003). Finally, the Federal Institute for Vocational Education and Training (Bundesinstitut für Berufsbildung, BiBB) gathers data on the average salary that the apprentices are paid (*Ausbildungsvergütungen*), while the state-level statistical offices compile statistics on the average salaries for workers, depending on their skill-level and the industry sector where they are working.[7] From these two variables, we constructed a measure of the opportunity cost of an apprenticeship training, namely, the relative wage of apprentices as compared to unskilled workers. We expect all these cost-related variables to lead to higher hazards of dropping out.

The prior level of schooling of respondents should also influence their costs of finishing an apprenticeship. Individuals with a higher level of prior school-

[7]However, these average salaries for unskilled workers are not available for all federal states and industrial sectors, reducing our sample size by approximately one third.

ing should have less problems in school and learn more easily, leading to lower costs of the apprenticeship. We included four dummies for respondents' previous level of schooling (dropouts, Realschule, and Gymnasium, as well as the ones who hold a Fachabitur), using the Hauptschule graduates as a baseline category. We expect respondents with a higher school leaving certificate to drop out less often because they should incur lower costs for an apprenticeship. Possibly, they also had a larger set of choices for an apprenticeship available and consequently, they should end up in a better match. This should also lead to lower dropout hazards, and to higher hazards of changing and upgrading.

As the descriptive results in earlier studies showed, various other variables could possibly influence dropout and changing decisions. Hence, we also included all the information on socioeconomic status of respondents that was available as control variables. We also included four dummies for the field of training as a substitute for industry sector information: technical, business-related, crafts and "simple" (mostly in services) occupations because there seem to be differences in dropout behavior across the fields (see Alda 2003). On the firm side, we included the available information on firm size (in four groups).

Our theoretical considerations predict higher incentives to invest in human capital in thicker labor markets. The thickness of a labor market cannot be captured directly, but there are different measures that can be used in order to proxy it. As a spatial bound, we just took the size of the respective Chamber's area. The relative immobility of apprentices can be seen as a justification for this simplifying assumption. On the supply side, we used the density of the working age population between 15 and 65. On the labor market demand side, we used the local unemployment rate as a proxy.[8] Additionally, the availability of public transport and traffic routes within each Chamber area should also influence the size of a local labor market. Commuting should be much easier in areas where there is a better transport network disposable because more jobs can be reached within reasonable time spans. We included the "population accessible by public transport within

[8]Results did not change when we used the youth unemployment rate instead.

one hour", a commonly used measure of transport smoothness in regional planning, as a measure of transport smoothness. We expect higher hazards of dropping out in thinner local labor markets.[9]

As a last group of regressors, we used data from the German Federal Employment Agency's statistics (Bundesagentur für Arbeit) on the labour market for apprentices and on the numbers of youth enrolled in full-time schools for usually dually provided occupations. The employment centers gather information on registered apprenticeship-seeking youths and on registered open apprenticeship places, and calculate a supply-demand ratio (the number of offered apprenticeship places per 100 apprenticeship seekers). However, as the employment centers can only use registered numbers for their calculations, these numbers do not give a complete picture of regional apprenticeship markets.[10] Many places are filled directly without the intermediation of the job centre and are therefore not included in the centres' statistics. Secondly, we included a measure aiming at capturing the relative frequency of non-firm-provided training in full-time vocational schools (*überbetriebliche Ausbildung*). This is a labor market measure where youths complete apprenticeship training in full-time schools, and not in both a firm and a school. We included the percentage of youths in this labor market measure among all youths in apprenticeship training in a region. These regressors are intended to control for regional differences in the labor market for apprentices. Riphahn (2002) and Mühlemann and Wolter (2006) both provide evidence for the importance of regional-level impact factors in vocational education, for employers as well as for youths. We expect both variables to lead to lower dropout hazards because matches should be better when there are

[9]Data on district level are available from the German Federal Office for Building and Regional Planning's "Indicators and Maps on Spatial and Urban Development" (Indikatoren und Karten zur Raum- und Stadtentwicklung, INKAR). These district-level data were then aggregated on chamber level and merged to the original data set, so that each individual was also assigned regional-level characteristics. We used information on regional unemployment rates, surface, working age population (between age 15 and 65) and availability of public transport. The working age population density is calculated as the ratio of working age population and surface. The availability of public transport is measured as the population that can be reached within one hour by public transport ("Erreichbares Bevölkerungspotential"), a commonly used measure in spatial development research.

[10]See, for instance, Ulrich (2006) for a more complete discussion of the topic.

more choices available or when firms can pick the best (and probably most motivated) candidates for an apprenticeship. o

2.5 Estimation Results

2.5.1 Simple Hazards

The following table displays results for our simple hazard rate estimations in various model specifications. The dependent variable takes the value of 1 if the individual dropped out of apprenticeship training and 0 else (i.e., he or she either stayed in the educational system or is a bankruptcy victim). We started by carrying out this simple hazard rate analysis because dropping out is the riskier educational choice as compared to staying within the educational system and merits therefore, in our opinion, a separate empirical analysis of its determinants. Dropping out in the following analysis refers to dropping out after dissolution of an apprenticeship contract as opposed to staying within the educational system. ***, **, and * denote significance levels of 1 %, 5%, and 10 %, respectively. Standard errors are given in brackets. These estimations include controls for the field of apprenticeship, the firm size and various regional-level impact factors, but the estimated coefficients are not reported in this table. However, the complete results can be found in Appendix A.2.1.[11]

Models I - III are estimations including a measure for the financial incentive to drop out represented by the ratio between the apprenticeship wage and the regional wage for unskilled workers in the same sector, for the entire sample (I), females (II) and males (III). Models IV - VI exclude the information on the financial opportunity cost measure (because this information is not available for all sectors and regions), and again, estimation coefficients presented here are for the entire sample (IV), females only (V), and males only (IV).

In this table, we present hazard ratios (exponentiated coefficients). The ef-

[11] Additional results for logistic (proportional odds) estimations of the same model confirmed our results, as well as a sensitivity check where we removed various regional-level variables from the estimation equations. The results for these additional estimations again confirm our results and are can be found in Appendix A.2.1.

fect of the regressor of interest on the hazard is significantly positive if the hazard ratio is significantly larger than one and significantly negative if the hazard ratio is significantly smaller than one.

Table 2.6: Simple Hazard Rates

	Model I	Model II	Model III	Model IV	Model V	Model VI
d1	0.107***	0.111*	0.123**	0.042***	0.043***	0.037***
	[0.071]	[0.141]	[0.106]	[0.015]	[0.023]	[0.018]
d2	0.272**	0.405	0.254	0.073***	0.078***	0.062***
	[0.180]	[0.513]	[0.221]	[0.026]	[0.041]	[0.031]
d3	0.649	1.084	0.596	0.132***	0.148***	0.112***
	[0.448]	[1.441]	[0.536]	[0.049]	[0.080]	[0.056]
d4	1.700	7.457	1.114	0.342***	0.751	0.195***
	[1.270]	[10.835]	[1.066]	[0.136]	[0.426]	[0.107]
d5	2.239		1.852	0.633	1.752	0.412
	[2.085]		[2.020]	[0.339]	[1.781]	[0.282]
1 = non-native parents	1.273	1.954	1.178	1.388*	1.188	1.476
	[0.322]	[0.918]	[0.362]	[0.268]	[0.425]	[0.349]
apprenticeship wage/wage unskilled	0.030***	0.008*	0.030***			
	[0.033]	[0.022]	[0.039]			
1 = female	0.938			0.824		
	[0.234]			[0.146]		
1 = male in occupation with	0.941		0.874	0.900		0.877
more than 60% females	[0.181]		[0.170]	[0.137]		[0.135]
1 = female in occupation with	1.279	1.253		1.193	1.175	
more than 60% males	[0.310]	[0.315]		[0.208]	[0.209]	
1 = school dropout	1.707*	2.488	1.539	1.754**	1.705	1.849**
	[0.537]	[1.560]	[0.563]	[0.406]	[0.658]	[0.538]
1 = Realschule	0.587***	0.515**	0.567**	0.582***	0.579***	0.586***
	[0.104]	[0.152]	[0.136]	[0.079]	[0.115]	[0.111]
1 = Fachabitur	0.203***		0.464	0.171***	0.066***	0.266**
	[0.108]		[0.268]	[0.080]	[0.068]	[0.142]
1 = Abitur	0.196***	0.199**	0.161*	0.283***	0.243***	0.343**
	[0.118]	[0.151]	[0.166]	[0.100]	[0.122]	[0.181]
1 = bad prospects	1.127	0.911	1.329	0.826	1.782	0.616
reason for termination	[0.504]	[0.922]	[0.714]	[0.301]	[1.001]	[0.299]
1 = bad income prospects	1.945**	2.913**	1.428	1.678**	2.578**	1.413
reason for termination	[0.581]	[1.483]	[0.585]	[0.398]	[0.972]	[0.453]
1 = bad career prospects	0.800	0.993	0.732	0.837	0.281*	1.205
reason for termination	[0.400]	[1.029]	[0.452]	[0.321]	[0.208]	[0.534]
1 = exam nerves	1.151	1.420	1.150	1.159	0.882	1.223
reason for termination	[0.326]	[0.864]	[0.381]	[0.239]	[0.311]	[0.324]
1 = financial distress	2.332***	2.651**	2.259***	1.847***	1.864*	1.766**
reason for termination	[0.527]	[1.279]	[0.600]	[0.331]	[0.600]	[0.396]
Observations	2329	818	1439	3879	1785	2094
LogL	-566.189	-182.985	-366.613	-978.400	-395.143	-567.219
Remarks		females only	males only		females only	males only

Notes: d1-d5 denote the timing of the dissolution of the apprenticeship contract (i.e. during probation, later during the first year, during the second, third and fourth year, respectively. The reference person is a male with German parents in neither a male- nor a female-dominated occupation who graduated from *Hauptschule*. He dissolved his first apprenticeship contract in a two-year apprenticeship contract in a firm

with less than ten employees. Estimations include controls for the field of apprenticeship, the firm size and various regional-level impact factors, i.e. the local percentage of youth in out-of-firm training, the local population density, the supply-demand ratio on the local market for apprenticeship places, the local unemployment rate and the local density of public transport.
Data sources: German Federal Institute for Vocational Education's statistics on apprenticeship wages (apprenticeship wages), German Federal Employment Agency's (Bundesagentur für Arbeit) statistics (supply-demand ratio on the labor market for apprentices, percentage of youth in out-of-firm training), German Federal Office for Building and Regional Planning's "Indicators and Maps on Spatial and Urban Development" (Indikatoren und Karten zur Raum- und Stadtentwicklung, INKAR) (local population density, local unemployment rate and the local density of public transport), German Federal Statistical Office, Gehalts-und Lohnstrukturerherbung im Produzierenden Gewerbe und im Dienstleistungsbereich (wages for unskilled workers), Survey "Vertragslösungen 2002 - Strukturen und Gründe" of the German Federal Institute for Vocational Education in 2002 (all other variables)

We start the discussion of our estimation results with the results for timing of the dropout decision (variables d1 - d5). It turns out that individuals who terminated their apprenticeship during probation time are significantly less likely to drop out as opposed to staying within the educational system in all model specifications. An early termination of the apprenticeship contract seems to lead to less difficulties of staying within the educational system.
The coefficient signs on cost- and benefit-related regressors show some empirical evidence for the predictions of our theoretical considerations. With respect to respondents' prior level of schooling, we find the descriptive findings confirmed. Individuals with a higher previous level of schooling are more likely to stay within the educational system after a dissolution of their apprenticeship contract, either as apprentices in another firm or as full-time students again. This could be due to lower costs of learning, but also to a higher level of awareness for the future consequences of dropping out. On the other hand, school dropouts are significantly more likely to drop out from apprenticeship training as well in estimations for the two largest samples (Models I and III) and for males in Model VI.
One of the short-term cost measures also shows a significantly positive coefficient sign. Individuals who said that financial distress was a reason for terminating their contract are significantly more likely to drop out as opposed to staying within the educational system. At the same time, higher apprenticeship wages relative to wages for unskilled workers in the same sector lead

to lower hazards of dropping out and working for example as an unskilled worker as opposed to staying within the educational system and not earning any wage. This ratio can be seen as a measure for the opportunity cost of completing an apprenticeship (and not working as an unskilled worker), and both results can be seen as a hint that the dropouts care more about financial issues than the non-dropouts. Also, individuals who said that bad income prospects were the reason for terminating their apprenticeship are significantly more likely to drop out, and this result seems to be driven by the females in the sample (the corresponding coefficients in the male-only estimations are not significant). This result is surprising and might be due to the fact that some dropouts want to change to another educational choice, but could not because of failing to find another apprenticeship place or full-time schooling opportunity.

Firm size dummies were included in the regressions, but they showed only significant coefficients for the largest firms (over 500 employees) and firms between 10 and 49 employees in the two models with the largest sample sizes (Model I and Model IV). In both cases, apprentices have a significantly higher hazard of dropping out.

Dummies for the field of occupation (crafts, technical, business-related and simple service occupations) were also included, where we found that apprentices in technical occupations have significantly lower hazards to drop out in models I, IV, V, and V. These occupations are often quite demanding, and the result could be due to the fact that apprentices who had a place in such an apprenticeship are more able and subsequently have less problems to find a new place. Surprisingly, none of the regional impact factors shows a significant impact on the hazard of dropping out of apprenticeship training as opposed to staying within the educational system.

In order to uncover possible differences in behavior across the different choices after terminating the apprenticeship contract using a control group of assumedly successful apprentices, we now turn to estimation results for a competing risks specification.

2.5.2 Competing Risks

The following table displays results for our competing risks estimations, where the control group are those apprentices whose contract was terminated because of bankruptcy of their firm. We assume that these apprentices would have graduated from apprenticeship training without the bankruptcy of their training firm and treat them as "successful graduates". Hence, this analysis focuses on the three different choices after dissolution of an apprenticeship contract instead of analyzing the decision to drop out as opposed to staying within the educational system, as in the simple hazard rate analysis. The different states into which a transition is possible are changing, upgrading and dropping out. ***, **, and * denote significance levels of 1 %, 5%, and 10 %, respectively. Again, we present exponentiated coefficients that can be interpreted as hazard ratios and results for a model with (I) and without (II) the financial incentive. The effect of the regressor of interest on the hazard is significantly positive if the hazard ratio is significantly larger than one and significantly negative if the hazard ratio is significantly smaller than one. Additional estimations for a complementary log-log specification of the model (assuming that transitions in the different choices can only occur at the boundary of time intervals) can be found in Appendix A.2.2. These estimations confirmed the results.

Table 2.7: Competing Risks Model: Full Results

	Change I	Change II	Upgrade I	Upgrade II	Dropout I	Dropout II
d1	37.994***	0.789	3.197	0.030***	1.489	0.077***
	[17.883]	[0.180]	[3.497]	[0.019]	[1.102]	[0.030]
d2	84.331***	1.492*	6.993*	0.052***	4.766**	0.157***
	[41.003]	[0.347]	[7.929]	[0.033]	[3.602]	[0.062]
d3	249.493***	3.320***	12.197**	0.064***	19.240***	0.406**
	[129.188]	[0.808]	[14.681]	[0.042]	[15.304]	[0.164]
d4	985.169***	6.708***	14.900*	0.095***	116.357***	1.719
	[591.535]	[2.069]	[23.886]	[0.084]	[102.748]	[0.780]
d5	378.525***	4.247*	0.000	0.000	134.545***	3.085
	[406.630]	[3.212]	[0.000]	[0.000]	[154.073]	[2.263]
apprenticeship wage/wage unskilled	0.000***		0.000***		0.000***	
	[0.000]		[0.000]		[0.000]	
1 = non-native parents	0.824	0.892	0.724	0.958	1.197	1.307
	[0.161]	[0.129]	[0.364]	[0.342]	[0.337]	[0.279]
1 = female	1.204	1.442***	0.584	0.597*	0.988	0.969
	[0.191]	[0.161]	[0.214]	[0.166]	[0.269]	[0.185]
1 = male in occupation with	0.955	0.972	0.536	0.524**	0.909	0.911
more than 60% females	[0.131]	[0.104]	[0.204]	[0.152]	[0.194]	[0.152]
1 = female in occupation with	0.641***	0.787**	1.159	1.107	1.037	1.023
more than 60% males	[0.105]	[0.086]	[0.437]	[0.312]	[0.280]	[0.194]
1 = school dropout	1.275	1.239	1.375	1.811	2.113**	2.311***
	[0.397]	[0.285]	[1.466]	[1.380]	[0.788]	[0.619]
1 = Realschule	1.003	1.229**	2.305**	2.431***	0.567***	0.630***
	[0.120]	[0.106]	[0.823]	[0.701]	[0.110]	[0.092]
1 = Fachabitur	0.992	0.902	2.637*	3.374***	0.175***	0.241***
	[0.241]	[0.162]	[1.516]	[1.405]	[0.102]	[0.097]
1 = Abitur	1.129	1.237	9.562***	12.250***	0.213**	0.345***
	[0.264]	[0.195]	[4.173]	[3.969]	[0.134]	[0.128]
1 = business	1.103	0.821*	1.637	1.204	1.434	0.847
	[0.239]	[0.097]	[1.093]	[0.392]	[0.490]	[0.163]
1 = crafts	0.474***	0.817	0.533	0.749	0.665	0.618**
	[0.111]	[0.104]	[0.388]	[0.304]	[0.245]	[0.126]
1 = technical	0.335***	0.733**	0.483	0.885	0.352***	0.464***
	[0.079]	[0.097]	[0.338]	[0.322]	[0.134]	[0.102]
1 = firm size	0.875	0.923	1.213	1.176	1.370	1.288*
betw. 10-49 employees	[0.112]	[0.082]	[0.412]	[0.307]	[0.281]	[0.193]
1 = firm size	1.069	0.840	2.770**	2.439***	1.568	1.116
betw. 50-99 employees	[0.205]	[0.115]	[1.173]	[0.768]	[0.467]	[0.252]
1 = firm size	0.892	0.806	0.959	1.627	1.075	1.137
betw. 100-499 employees	[0.167]	[0.116]	[0.432]	[0.540]	[0.343]	[0.262]
1 = firm size	1.173	0.874	1.434	1.568	1.925*	1.509
over 500 employees	[0.259]	[0.148]	[0.682]	[0.562]	[0.690]	[0.392]
1 = bad prospects	1.706*	1.371	0.491	1.042	1.517	1.026
reason for termination	[0.514]	[0.302]	[0.419]	[0.592]	[0.731]	[0.398]
1 = bad income prospects	1.242	1.652***	0.943	1.242	2.227**	2.155***
reason for termination	[0.321]	[0.299]	[0.576]	[0.572]	[0.780]	[0.586]
1 = bad career prospects	1.140	1.236	2.554*	2.015	0.707	0.795
reason for termination	[0.354]	[0.282]	[1.434]	[0.907]	[0.390]	[0.335]
1 = exam nerves	0.649	0.407***	0.409	0.212	1.034	0.892
reason for termination	[0.193]	[0.087]	[0.427]	[0.217]	[0.349]	[0.215]
1 = financial distress	0.565**	0.692**	0.828	0.598	2.320***	1.755***
reason for termination	[0.158]	[0.127]	[0.623]	[0.362]	[0.645]	[0.371]
local percentage of youth	86.733***	42.538***	53.919*	6.962	6.321	1.879
in out-of-firm training	[72.823]	[26.046]	[110.873]	[12.476]	[9.171]	[2.082]
local population density	9.385	0.865	2,692.193*	3.709	31.654	0.420
	[16.974]	[1.097]	[12,738.170]	[13.720]	[92.729]	[0.890]
local supply-demand ratio	1.979**	1.786**	1.681	1.433	0.864	0.996
on the job market for apprentices	[0.641]	[0.411]	[1.538]	[1.020]	[0.514]	[0.392]
local density of public transport	0.066**	0.886	0.003	0.775	0.099	5.506
	[0.090]	[0.832]	[0.011]	[2.136]	[0.217]	[8.792]
local unemployment rate	0.000***	0.000***	0.000***	0.000*	0.000	0.099
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.448]
n	2394	3991	2394	3991	2394	3991
LogL	-1958,908	-3535,605	-1958,908	-3535,605	-1958,908	-3535,605

d1-d5 denote the timing of the dissolution of the apprenticeship contract (i.e. during probation, later during the first year, during the second, third and fourth year, respectively. The reference person is a male with German parents in neither a male- nor a female-dominated occupation who graduated from *Hauptschule*. He dissolved his first apprenticeship contract in a two-year apprenticeship contract in a firm with less than ten employees. Estimations include controls for the field of apprenticeship, the firm size and various regional-level impact factors, i.e. the local percentage of youth in out-of-firm training, the local population density, the supply-demand ratio on the local market for apprenticeship places, the local unemployment rate and the local density of public transport.
Data sources: German Federal Institute for Vocational Education's statistics on apprenticeship wages (apprenticeship wages), German Federal Employment Agency's (Bundesagentur für Arbeit) statistics (supply-demand ratio on the labor market for apprentices, percentage of youth in out-of-firm training), German Federal Office for Building and Regional Planning's "Indicators and Maps on Spatial and Urban Development" (Indikatoren und Karten zur Raum- und Stadtentwicklung, INKAR) (local population density, local unemployment rate and the local density of public transport), German Federal Statistical Office, Gehalts-und Lohnstrukturerherbung im Produzierenden Gewerbe und im Dienstleistungsbereich (wages for unskilled workers), Survey "Vertragslösungen 2002 - Strukturen und Gründe" of the German Federal Institute for Vocational Education in 2002 (all other variables)

Duration effects are captured by the dummy variables on the period of time in which the apprenticeship contract was terminated (i.e. probation, remainder of first year, second year, third year, fourth year). These effects are non-monotonic for changers and for upgraders, and this result supports our decision to use a non-parametric specification of the baseline hazard.
Unlike in the simple hazard specifications, several regional-level impact factors now significantly affect transition rates. With respect to the local unemployment rate, we find that the hazards of changing and upgrading are significantly lower, the higher the unemployment rate is. This result is surprising, as we did not expect to find any impact of the local labor market situation on the hazards of transition into these two educational choices as opposed to graduating. We do not find any impact of the theoretical prediction that a thinner local labor market should lead to higher hazards of dropping out as opposed to graduate from apprenticeship training.
A higher local supply-demand ratio on the job market for apprentices leads, as expected, to significantly higher hazards for changing as opposed to staying in the same apprenticeship and graduate: when there are more places available, it is of course much easier to find a new apprenticeship place instead of

staying in the first one. The higher the number of youth in out-of-firm training, the higher is the hazard of changing as opposed to staying in the first apprenticeship and graduate. This could be due to the fact that typically only the better school leavers get places in dual training in regions with a high incidence of out-of-firm training. Consequently, they probably also have less problems to change and find another apprenticeship place. However, while we did expect higher hazards of dropping out as opposed to graduating in thinner local apprenticeship markets, we do not find any impact of this regressor on the hazards of dropping out. Also, a higher percentage of youths in out-of-firm training leads (in the smaller sample) to significantly higher hazards of going back into full-time education as opposed to graduating. This might be due to the fact that there is typically less apprenticeship training provided in regions with higher numbers of out-of-firm training, meaning that it is harder to get an apprenticeship place in these regions and relatively easier to go back into full-time schooling after the dissolution of an apprenticeship contract.

The previous level of schooling affects the transition rates into upgrading and into dropping out, as expected, and into changing for Realschule graduates in the larger sample, where Realschule graduates are more likely to change. Individuals with a higher level of previous schooling have significantly higher hazards of upgrading and significantly lower hazards of dropping out. School dropouts, on the other hand, have a significantly higher hazard of dropping out from apprenticeship training as well. This confirms results from previous research on the topic and provides evidence for our theoretical prediction that individuals with more schooling should have higher hazards of upgrading and lower hazards of dropping out. Finally, we find that individuals with higher previous levels of education (*Realschule, Fachabitur, Abitur*) have significantly higher hazards of upgrading. For the holders of an Abitur, this is probably due to the fact that they can also enter universities or universities of applied sciences (*Fachhochschulen*). Also, the costs of learning are probably lower for individuals with a higher level of education, making them more likely to enter full-time education again.

We expected a high importance of bad income and career prospects on the

hazards of changing and upgrading as opposed to graduating from apprenticeship training while we did not expect to find any impact on the hazards of dropping out as opposed to graduating. However, we find that the hazards of dropping out are significantly higher for those who said thad bad income perspectives were a reason for them to terminate their first apprenticeship. It might be the case that those individuals are planning to go to another educational choice but have not done so yet. Also, as expected, individuals who stated that bad income prospects were a reason for dissolving their apprenticeship contract have significanly higher hazards of changing, but only in the larger sample. Those who said bad prospects in general were a main reason to terminate have a significantly higher hazard of ending up with a change, but only in the smaller sample. In the estimations including information on relative wages, we also find that perceived bad career prospects lead to significantly higher hazards of upgrading, which makes sense because a higher level of education typically leads to better career options.

The result that dropouts seem to care too much about short-term financial issues from the simple hazard rate estimations is confirmed by the competing risks estimation results. It is especially disturbing that youths who named financial distress and bad income prospects as the reason for dissolving their apprenticeship contract have significantly higher hazards of dropping out as opposed to graduate: this decision will probably worsen their financial situation considerably in the long term, even if they are better off in the short term with the higher salary of an unskilled worker as compared to the apprenticeship wage. There are two candidate explanations for the importance of these two impact factors. The first one is that dropouts might suffer from a lack of awareness for the long-term consequences of their dropout decision, either because they do not have information about wages for graduates and dropouts from apprenticeship training or because they "duck issues". The second one is that their discount rate for future payoffs is simply too high, implying that it is indeed a rational decision for them to drop out given their individual discount rate. However, with the information available in this dataset, we are not able to analyze these conjectures in more detail.

We now turn to estimation results on the field of individuals' first appren-

ticeship. The reference group here are apprentices in "simple" occupations with a duration of two years, most of them in the tertiary sector. Individuals who started their first apprenticeship in a technical occupation have significantly lower hazards of changing and dropping out as opposed to graduating in both specifications. The same result appears for individuals with a first apprenticeship in a crafts occupation (for changing in the smaller model and for dropping out in the larger one). Finally, individuals who started their first apprenticeship in a business-related occupation have significantly lower hazards of changing in the larger sample.

Being female significantly affects the transition rate into changing and upgrading, but not into dropping out in the model specifications without including the wage ratio. More precisely, females have significantly higher hazards to transit into changing and significantly lower hazards to transit into upgrading as opposed to graduating from apprenticeship.

The overall results seem to suggest that there are indeed remarkable differences in behavior across the different educational choices and that it is useful to distinguish between them instead of focusing exclusively on dropouts.

2.6 Conclusion

In the present paper, we analyzed revisions of youths' educational choices. Unlike previous research, we did not focus exclusively on dropping out as one revision of an educational decision, but we considered also the choices of changing and upgrading. Using theoretical considerations from human capital theory and matching theory, we tested the hypotheses that general cost-related impact factors should be more important for the dropouts, while costs due to bad matches should be higher for the changers. The upgraders should possibly be underchallenged and change to a more demanding educational choice. In addition, we expected stronger incentives to complete apprenticeship education in thicker local labor markets, where employment opportunities after graduation are better, leading to better matches and hence to higher benefits of a completed education. We used a data set on revisions of educational choices in vocational education, where the different choices

can be distinguished very clearly.
A simple hazard rate analysis of the decision to drop out vs. staying in the educational system revealed a high importance of various monetary impact factors. The fact of experiencing financial distress significantly increased the hazard of dropping out, as well as stating bad income prospects as the main reason to drop out of vocational education. Also, the lower the financial opportunity cost of an apprenticeship is (measured as the apprenticeship wage relative to the wage for unskilled workers in the same sector), the lower is the hazard of dropping out. These results could point toward the possibility that dropouts are too much guided by short-term monetary considerations when deciding about their education. They also confirmed our hypothesis that cost-related impact factors seem to be decisive for dropout decisions.
With respect to previous educational attainment, we find that individuals with a higher level of previous schooling have lower hazards of dropping out. This result confirms findings from earlier studies and our hypothesis and could be due to at least two different reasons: either lower costs of learning or better decision-making abilities for more able individuals.
In the competing risks estimations, we find additionally that various local labor market measures affect the hazards of transition in the different states significantly. More precisely, more available apprenticeship training places on the local job market lead to a higher hazard of changing and a higher local unemployment rate leads to significantly lower hazards of changing and upgrading. These results confirm our hypothesis that individuals should have weaker incentives to invest in human capital in thinner local labor markets.
Revising an educational choice is not risky per se, but dropping out of the educational system without a certificate that qualifies its holders for skilled jobs and many further training possibilities is. Our results indicate that there are indeed different determinants for the different educational choices and several policy measures could be promising in order to avoid "true" dropouts, including increasing apprentices' regional mobility in order to achieve better matches between apprentices and firms and increasing youths' awareness for the long-term consequences of dropping out, including the foregone earnings losses due to lower wages and higher unemployment risk for unskilled work-

ers.

The main disadvantage of the data set that we have used for the empirical analysis is without any doubt the fact that it does not contain a true control group of successful graduates from apprenticeship training. Also, the lack of information on possible impact factors such as family background, cognitive ability or characteristics of the training firm are of course drawbacks. MATCHING PROBLEMS However, as there are not many datasets available that contain information on revisions of educational choices, we still believe that our first results are interesting and might lead to the development of studies focusing on such revisions or to the inclusion of questions dealing with revisions of educational choices in existing data sets.

Future research on the topic could either include an analysis of the consequences of dropping out from vocational education using longitudinal datasets or focusing on other possible impact factors, such as firm or instructor characteristics.

This chapter analyzed the determinants of educational choices after the termination of an apprenticeship contract, and especially the decision to drop out as a risky educational choice. The next chapter introduces the notion of critical periods for educational investments, thereby introducing a dynamic component into the human capital theory framework. It focuses on the impact of marijuana use as a widespread risky behavior among adolescents on their educational outcomes, measured as having finished a secondary or tertiary education.

Chapter 3

Marijuana Use, Educational Outcomes and Labor Market Success: Evidence from Switzerland

(ISU Economics of Education Working Paper Nr. 43)

3.1 Motivation

Binge drinking among youths has become a common phenomenon in many countries, as well as use of marijuana, hallucinogens and other drugs. According to the European School Survey Project on Alcohol and Other Drugs[1] in 2003, about 21% of 16-year-old students in nearly 40 European countries had used cannabis at some point in their life. In Switzerland, the lifetime prevalence for the same age group was even 40 % in the same year. The short-term effects of risky behavior, such as hangovers and drug-related accidents, are immediately clear, but there also exists evidence on the long-term consequences of risky behavior. Economic research on risky behavior of youths has shown that at least some risky behaviors seem to translate causally into lasting negative impacts on human capital accumulation of individuals.
At the same time, use of illegal drugs and drug policy is a heavily ideological

[1] www.espad.org

issue. The supporters of marijuana legalization often argue that its use is less "damaging" than the use of other drugs, such as cocaine or heroine, but the existing evidence for this statement is less than conclusive. This paper analyzes the impact of age of onset of marijuana use in adolescence on educational and labor market outcomes. Existing economic research on risky behavior focuses in most cases on a specific subsample of the population, for example high school students, on relatively short-term consequences for outcomes, for example grades, and tries in most cases to analyze the impact of a risky behavior at any point in time on outcomes such as years of schooling. We present several innovations. First of all, the theoretical literature on human capital investments either followed an education economic (Becker 1962, Ben-Porath 1967) or a health economic (Grossman 1972) point of view. The two types of models have different implications for an individual's stock of human capital: while investments in education increase individual productivity, health investments increase the amount of time available for production. In a recent paper, James Heckman (2007) proposed a synthesis of the two distinct literatures on health and education economics and developed a lifetime model of investment in human capital. In his model, altruistic parents invest into their offspring's capabilities (i.e. cognitive and non-cognitive skills, and health). The model features characteristics that capture insights from neurological and medical research on the development of human capabilities. Heckman's model allows for the identification of critical and sensible periods during youth. We use this concept and test if there are more or less detrimental periods with respect to timing of initiation of marijuana use and their respective impact on educational and labor market success of the individual. It might be the case, for example, that early initiation into marijuana use is harmful, while later initiation is harmless. Second, we take a longer-term perspective with respect to outcomes and analyze educational outcomes and labor market status. While grades are undoubtedly an important measure of human capital accumulation, having finished secondary education is essential for earnings and employment prospects and the prerequisite for entering further education, such as master craftsman courses. Third, we measure educational success as having finished at least a secondary-level or

a tertiary-level education instead of analyzing the impact of risky behavior on years of schooling. There is considerable evidence on "sheepskin effects" in education, i.e. the fact that there are wage increases above what would normally be attributed to the extra year of education, for numbers of years of education that usually correspond to the completion of a degree (Hungerford and Solon 1987). In other words, degrees have an additional signalling value on the labor market. In addition, having earned a degree is the prerequisite for many further education possibilities, while years of schooling do not matter. Fourth, we analyze a representative sample of the population, not only high school or college students, and we use a novel instrumental variable, the local number of drug-related offences as a supply-side instrument. We believe that this is a convincing instrument to establish the causal effect of marijuana use at different periods in youth on our outcomes of interest, as it should be uncorrelated with individual unobservable characteristics that might drive both the decision to use marijuana and educational success.

Our results from both a simple probit and a multivariate probit approach suggest that there are indeed critical periods for the ages of onset of marijuana use. Onset of marijuana use under age 14 significantly decreases the probability of having finished at least a secondary education, meaning that early adolescence before age 14 is a critical period for the educational outcome of having finished at least a secondary education. While we do not find any effect of marijuana use on the probability of having a tertiary education, having started to smoke marijuana under age 16 significantly increases the probability of being unemployed, even after controlling for educational attainment. It might be the case that early marijuana initiation is harmful for personality traits that are decisive for labor market success in addition to educational attainment, such as discipline and reliability. Inititation before age 16 seems to be a critical period for later labor market success. As we derived these results from a multivariate probit instrumental variable estimation strategy that takes the possible endogeneity of marijuana use into account, we are confident that they represent indeed a causal effect.

The remainder of this paper is organized as follows. Part 3.2 presents a brief literature review for results on various risky behaviors. Part 3.3 introduces

the data set and provides descriptive statistics, part 3.4 outlines our estimation strategy and presents the results, and part 3.5 concludes and discusses the limitations of the findings presented.

3.2 Literature Review

In the last few years, literature on the impact of various risky behaviors on the accumulation of human capital and on labor market outcomes of young adults has considerably increased. The newer studies also take into account possible biases of the results due to endogeneity problems and adress these issues using different identification strategies. We start this literature review with the effects of alcohol use. DeSimone and Wolaver (2005) analyze the impact of alcohol use on grades in high school. Using the Youth Risk Behavior Survey and proxies for unobserved individual characteristics like risk and time preference and mental health, they find a significantly negative impact of alcohol use on grades. Not surprisingly, the negative effect of binge drinking (defined as having five or more alcoholic drinks within a few hours) they find is over twice as large as the effect of any alcohol use. Williams et al. (2003) use the Harvard School of Public Health's College Alcohol Study in order to estimate the effect of alcohol use on grades in college, using state-level alcohol prices as instruments, and find a negative effect via reduced hours of studying due to alcohol use.

On a closely related topic, the impact of drinking on high school dropout, Chatterji and DeSimone (2005) use the National Longitudinal Survey of Youth (NLSY) 1979 Young Adults and an instrumental variables approach in order to identify the causal effect of alcohol use. Their IV estimates show even larger negative coefficients than their OLS estimates and a significantly negative impact of both drinking and binge drinking on the probability of finishing high school.

With respect to early labor market outcomes of young adults, Chatterji and DeSimone (2006) analyze the impact of drinking while in 10th grade on wages and employment status. Using an OLS strategy because of the lack of convincing instruments, they find significantly positive wage effects for males

and no effects for females. They conjecture that binge drinking is correlated with unobserved social skills that are remunerated by employers. These results suggest that alcohol use is detrimental to relatively short-term outcomes such as grades, but that there might be positive labor market effects of alcohol consumption. However, as the results for labor market outcomes are derived in simple OLS estimations, it might be the case that they do not reflect a causal relationship.

We continue with the literature on effects of smoking. Cook and Hutchinson (2006) analyze the effects of both smoking and drinking in 11th grade on the probability of finishing high school. While they do not find an effect of drinking, they do find one of smoking and explain this finding by smoking as a signal of "being off track" in school. Hence, peer effects, not interpersonal differences in time preference, seem to be the transmission channel for their findings. It should also be noted that their results for drinking are at odds with the findings by Chatterji and DeSimone (2005) who find a significantly negative impact of drinking on the probability of graduating from high school. Levine et al. (1997) also use the NLSY and different fixed-effects methods (panel and siblings fixed effects) for their analysis of the effect of smoking on wages and find that smokers' wages are between 4 and 8 % lower than nonsmokers' wages.

We finish this brief survey with some earlier results on our topic of interest, the impact of marijuana use on educational success. Liccardo Pacula et al. (2003) use the National Education Longitudinal Study and a differences-in-differences approach and find that marijuana use in high school does not seem to have an impact on results in standardized test scores, except for the scores in mathematics. Register et al. (2001), however, use the NLSY and two-stage least squares estimation and find that marijuana use as well as use of other drugs reduce educational attainment by about one year.

Van Ours and Wechsler (2009) use an Australian data set and duration model identification approaches in order to assess the causal impact of the timing of marijuana initiation on educational attainment. They find that earlier initiation into cannabis use leads to a significant reduction of years of schooling, and that this effect is larger for females. However, none of these papers

analyze the impact of marijuana consumption on the probability of actually graduating from high school or college which is probably a more sensible measure of educational attainment than focusing on years of schooling.
To sum up, the results seem to suggest that there are indeed adverse effects of smoking and marijuana initiation during high school on educational outcomes. For the case of alcohol and marijuana use, it seems to be the case that combined use of both drugs has adverse effects on the hippocampus of adolescents, a region of the brain that is related to mnemonic and learning abilities (see Lisdahl Medina et al. 2007 for more details). This finding could provide a neurological explanation for the worse educational outcomes of teenage alcohol and marijuana users. However, none of these previous papers analyzes longer-term educational outcomes such as finishing a tertiary education using a representative sample of the population, and none of them takes at the same time the possibility into account that there are critical and non-critical periods for marijuana initiation.
In the next section, we continue with a brief description of our data set and descriptive statistics.

3.3 The Data Set

Our empirical analysis is based on the 2002 Swiss Health Survey (Schweizerische Gesundheitsbefragung), a representative sample of the Swiss resident population. It is carried out every five years by the Swiss Federal Statistical Office in order to gain insights on the health status of Switzerland's population age 15 and older. Questions include the physical, mental and social health status; conditions of living, health-related behavior, but also items like repondents' level of education, employment and income and many more. The survey consists of two parts, the first one being a computer-assisted telephone interview, the second one being a questionnaire that was sent out to participants of the phone interview. The total sample size is $n = 19{,}706$, but we used only respondents age 40 and under for our empirical analyses because the data for our instrumental variable are only available for this time period. In addition, we have restricted the sample to respondents who have

indicated that they are not in full-time training anymore, meaning that they are likely to have completed their education, because we are interested in the determinants of the probabilities of having finished an educational degree. Our restricted sample still consists of 4,998 individuals.

Data on the cantonal-level availability of marijuana, our instrumental variable, measured as the number of drug trafficking delicts per capita at the time when the individual started to use marijuana, were taken from the Swiss Federal Statistical Office's Police Drug Statistics ("Polizeiliche Betäubungsmittelstatistik) since 1974.

The following section provides some interesting descriptive features of the data set. Complete summary statistics for the other variables of interest are provided in Appendix B.1.

The lifetime prevalence of marijuana use in the entire sample is 27.99%. 2.13% of individuals started to smoke marijuana before they turned 14, but 8.11% started between age 15 and 16 and another 9.66% started between age 17 and 18. The rest started marijuana use later in life.

Table 3.1: Age of onset of marijuana use

	Onset of marijuana use	Number of users
Never	72.01%	3599
Under 14	2.13%	106
Betw. 15-16	8.11%	405
Betw. 17-18	9.89%	494
Betw. 19-20	5.07%	253
Betw. 21-22	1.31%	65
Betw. 23-24	0.71%	35
Betw. 25-26	0.77%	38

Source: Swiss Health Survey 2002, own calculations

The vast majority of all respondents in the sample has finished at least a secondary education, either school-based or in the vocational system. Only around 2.48% of individuals have not finished compulsory schooling, and 11.3% have at least finished compulsory schooling. However, only 7.57% of respondents have a university-level tertiary education, but another 11.03% have a tertiary-level vocational education.

A look at educational outcomes by the age of onset of marijuana use reveals a much higher percentage of individuals with only compulsory schooling among respondents who started before they turned 14. Also, among those who started age 15 and 16, the percentage of individuals with no more than compulsory schooling is higher than among the never-smokers. However, among those who started between age 17 and 18, the number is lower (5.18%) than in the entire sample.

Table 3.2: Educational outcomes by age of onset of marijuana use

	Never	Under 14	15-16	17-18	Later	All
Not answered	0.09%	0%	0.21%	0 %	0%	0.08%
Less than compulsory	2.59%	6.3%	3.73%	1.53%	0.38%	2.48%
Compulsory school	11.75%	27.56%	13.66%	7.81%	5.18%	11.3%
Secondary: general	6.39%	6.30%	8.70%	8.32%	5.57%	6.72%
Secondary: vocational	61.46%	45.67%	57.56%	62.31%	60.08%	60.81%
Tertiary: vocational	10.93%	11.02%	10.14%	9.34%	15.55%	11.03%
Tertiary: university	6.78%	3.15%	6.00%	10.70%	13.24%	7.57%
n	3463	127	407	480	521	4998

Source: Swiss Health Survey 2002, own calculations

Finally, we look at labor market success, measured as being employed. In the entire sample, only 1.96% of respondents were unemployed. This percentage is higher for all groups of marijuana users, and it is lower (1.56%) for those who have never used marijuana. The highest unemployment rate is found among those who started to use marijuana before age 14, and unemployment rates decline for those who started in later age periods.

Table 3.3: Unemployment rate by age of onset of marijuana use

	Unemployment rate
Never	1.56%
Under 14	4.72%
Betw. 15-16	3.73%
Betw. 17-18	2.55%
Later	2.11%
Entire Sample	1.96%

Source: Swiss Health Survey 2002, own calculations

In the next section, we turn to our estimation strategy and empirical results.

3.4 Estimation Strategy and Results

3.4.1 Theoretical Considerations and Estimation Method

Heckman's (2007) model describes how skills evolve over time as a function of initial endowment h that is determined by parental characteristics, the vector of skill stocks in the previous development period θ_t, and parental investment I_t, assuming the following technology:

$$\theta_{t+1} = f_t(h, \theta_t, I_t) \tag{3.1}$$

The stock of skills at a given period can be rewritten as a function of all past investments by repeatedly substituting for θ_t, θ_{t-1}, resulting in the following expression:

$$\theta_{t+1} = m_t(h, \theta_1, I_1, ..., I_t), t = 1, ..., T \tag{3.2}$$

In order to analyze our research question, we assume that investments or disinvestments are carried our by adolescents themselves, with the health disinvestment of interest being marijuana consumption. A critical period t^* for our outcomes of interest is then defined as:

$$\frac{\partial \theta_{t+1}}{\partial I_s} = \frac{m_t(h, \theta_1, I_1, ..., I_t)}{\partial I_s} \equiv 0 \tag{3.3}$$

but

$$\frac{\partial \theta_{t+1}}{\partial I_{t^*}} = \frac{m_t(h, \theta_1, I_1, ..., I_t)}{\partial I_{t^*}} < 0 \tag{3.4}$$

These two equations state that a disinvestment, such as the decision to start marijuana consumption, is unproductive (i.e. it lowers the probability of reaching a certain educational degree) if it takes place in period t^*, but not if it takes place in other periods $s \neq t^*$. It could be the case, for example, that onset of consumption below a certain age is harmful for educational success, while later onset in another developmental period is not.

In order to assess empirically whether onset of marijuana consumption in different periods in youth affects educational outcomes and labor market

success, we work with a multivariate probit model.[2] This model assumes that error terms are multivariate normal with mean zero and a variance-covariance matrix V, where V has off-diagonal elements of $\rho_{jk} = \rho_{kj}$, and unit diagonal elements. The likelihood function is evaluated using the Geweke-Hajivassiliou-Keane smooth recursive simulator. It splits the joint normal probability density function into simulated conditional probabilities from a truncated normal distribution. The joint probability can then be written as the product of these conditional simulated probabilities.

We estimate the following four-equation model by simulated maximum likelihood:

$$outcome_i = \begin{cases} 1 & if \quad \alpha d1_i + \beta d2_i + \gamma d3_i + \delta X_i + \epsilon_{i1} > 0 \\ 0 & else \end{cases}$$

$$d1_i = \begin{cases} 1 & if \quad \theta IV1_i + \delta X_i + \epsilon_{i2} > 0 \\ 0 & else \end{cases}$$

$$d2_i = \begin{cases} 1 & if \quad \theta IV2_i + \delta X_i + \epsilon_{i3} > 0 \\ 0 & else \end{cases}$$

$$d3_i = \begin{cases} 1 & if \quad \theta IV3_i + \delta X_i + \epsilon_{i4} > 0 \\ 0 & else \end{cases}$$

Our outcomes of interest in the first equation are having at least a secondary education and having a tertiary education as measures of educational success, and being unemployed as a measure of labor market success. $d1$, $d2$ and $d3$ denote our regressors of interest, dummy variables for onset of marijuana consumption under age 14, between age 15 and 16 and between age 17 and 18, respectively. X denotes a vector of control variables, and IV denotes the instrumental variables that we use.

It is quite likely that in fact both marijuana consumption and educational attainment are driven by unobserved characteristics such as time preference. Hence, estimation of only the first equation would yield inconsistent esti-

[2] All estimations were carried out using Stata's mvprobit module, written by Cappellari and Jenkins (2003).

mates of our regressors of interest because it would not take into account the likely correlations between the error terms.

In order to assess the causal impact of marijuana consumption on educational outcomes, we use an instrumental variables estimation strategy. We use two instruments: the first one are canton-level data on the availability of the drug, measured as the number of drug trafficking delicts per capita at the time when the individual started to use marijuana.These data were taken from the Swiss Federal Statistical Office's Police Drug Statistics ("Polizeiliche Betäubungsmittelstatistik) since 1974. The second one is the individual's self-stated level of religiousness. The crucial assumptions for these being valid instruments for marijuana consumption are that they have to be uncorrelated with individual-level unobserved characteristics (e.g., time preference or ability) that are possibly driving both educational and drug consumption decisions and that they have to be correlated with individual-level marijuana consumption. While the first assumption is untestable, we think that it is not completely unreasonable to believe that it is true in our setup. As far as we know, the econometric literature does not provide any formal tests on instrument relevance or validity for nonlinear models with several endogenous variables. Following Koedel (2008), we ran a series of univariate probits and performed Likelihood Ratio tests in order to assess the relevance of our instruments. The Likelihood Ratio test rejected the hypothesis of instrument irrelevance at the 1%-level for onset of consumption aged 15 and 16 and aged 17 and 18 for both the regional and the individual-level religiousness instruments. The hypothesis of instrument irrelevance was rejected at the 5%-level for religiousness for those who started using marijuana below age 14, but it was not rejected for the regional availability for this age group. However, these univariate probit-based tests do not take into account that the instruments predict several endogenous regressors and hence they are only imperfect. Results for these tests can be found in Appendix B.2.3, as well as the estimation results for equations $d1_i$ - $d3_i$ in the multivariate probit model.

3.4.2 Selection and Construction of Variables

We measure educational outcomes as having at least a secondary-level education (vocational or school-based) and having a tertiary-level education (vocational or university-level). The dependent variable in the educational success regressions is an indicator variable that takes the value of 1 if the individual has at least a secondary-level education or a tertiary-level education, respectively. For the labor market estimations, our dependent variables is an indicator variable that takes the value of 1 if the individual is unemployed.
The vector X contains information on respondents' gender, age, their own and their parents' citizenship and proxies for individuals' risk attitude and time preference. We include information on an individuals' self-reported importance of health and a balanced diet, their body mass index and if they use sunscreen. Lastly, we added a set of dummy variables for the respondents' region of origin and the size of the respondents' place of residence.
For the labor market success estimations, we additionally include an indicator variable for being married and on the number of occasions that individuals were engaged in binge drinking activities during the last year (defined as having more than 6 or 8 alcoholic drinks on one occasion for females and males, respectively).[3]
Our regressors of interest in the estimations are dummy variables for the age when respondents started to smoke marijuana (under 14, between 15 and 16, between 17 and 18). We also have information on later onsets of marijuana use, but we do not use it in the empirical analysis of having finished at least a secondary education. The reason is that most respondents in the sample have finished a secondary-level education that typically ends at age 18, hence, later onset of marijuana use should of course not have an impact on educational outcomes any more. We do, however, insert a dummy variable for later onset of marijuana consumption in the regressions for having

[3]We do not include this information in the regressions for educational outcomes because a binge drinking episode in the year before the interview should not matter for educational successes from the past. Unfortunately, there is no variable on binge drinking during youth in the Swiss Health Survey. The same argument holds true for marriage which takes usually place during the years after finishing education.

at least a tertiary education and being unemployed.
Lastly, the two instrumental variables that we use are a regional supply-side IV and a measure of individuals' self-reported religiousness. The regional IV consists of the canton-level number of drug-related accidents at the time when the individual started to use marijuana. This can be seen as a classical supply-side instrument. The underlying assumption for this being a valid IV is that an individual should be more likely to start smoking marijuana when the drug is more readily available, which should be the case when there are more drug-related accidents. At the same time, there is no reason to believe that there are differences across the different cantons with respect to ability or time preference as two candidate unobservables that might be driving both the decision to smoke marijuana and educational success. The measure of religiousness states on a scale from 1 to 7, where 1 means that the individual never attends religious services and 7 that he or she attends services every day. The assumption here is that more religious individuals should incur higher psychological costs of drug consumption and the probability of drug consumption should therefore decrease with their level of religiousness. Also, there is no evidence that there are differences with respect to time preference (Benjamin et al. (2009) do not find any effect of religious identity on time preference) for individuals with different levels of religiousness.
In order to be able to assess the impact of marijuana consumption during different periods in youth on our outcomes of interest, compared to indviduals who have never used marijuana, we have to work with two slightly different samples. As secondary education is usually finished at age 18, we delete all individuals who have started to smoke marijuana after the age of 18 from our sample in order to be able to compare the outcomes of those who have used marijuana at some point during their youth to the outcomes for those who have never used marijuana. The timing of tertiary education, however, especially for those in vocational education, is harder to determine. Later onset of marijuana use might also matter for individuals' employment status. Hence, we included another dummy variable into these estimations that takes the value of 1 if the respondent has started to use marijuana at any point in time after the age of 18.

3.4.3 Results

Educational Outcomes

The following table presents results from simple probit and multivariate probit regressions for having at least a secondary-level and a tertiary-level education as the dependent variable. Cluster-robust standard errors are given in parentheses (clustering on region of origin). ***, **, and * denote significance levels of 1 %, 5%, and 10%, respectively. The regressions included controls for region of origin and the size of individuals' place of residence. Complete estimation results including estimated coefficients on all control variables are provided in Appendix B.2.1.

Table 3.4: Educational Outcomes: Regression Results

	secondary mvprobit	secondary probit	tertiary mvprobit	tertiary probit
1 = Marijuana under 14	-0.367*	-0.391***	0.187	0.067
	[0.216]	[0.112]	[0.248]	[0.137]
1 = Marijuana 15-16	-0.146	0.039	-0.197	-0.127*
	[0.226]	[0.087]	[0.192]	[0.072]
1 = Marijuana 17-18	0.104	0.194***	-0.221**	-0.068
	[0.278]	[0.047]	[0.109]	[0.070]
1 = Marijuana over 18			0.098	0.193**
			[0.161]	[0.089]
Age	0.079***	0.080***	0.050***	0.049***
	[0.006]	[0.006]	[0.004]	[0.003]
1 = Female	-0.114	-0.103*	-0.673***	-0.658***
	[0.073]	[0.060]	[0.057]	[0.052]
Body Mass Index	0.000	0.001	-0.025***	-0.025***
	[0.004]	[0.004]	[0.008]	[0.007]
1 = high level of mastery	0.031	0.036	0.011	0.016
	[0.038]	[0.039]	[0.024]	[0.021]
1 = high level of optimism	0.084	0.086	0.141***	0.140***
	[0.055]	[0.055]	[0.021]	[0.021]
1 = uses sunscreen	0.407***	0.408***	0.205**	0.203**
	[0.051]	[0.048]	[0.090]	[0.090]
1 = health important	-0.079*	-0.073	0.015	0.020
	[0.044]	[0.047]	[0.027]	[0.027]
1 = nutrition important	0.237***	0.233***	0.102	0.098
	[0.021]	[0.021]	[0.071]	[0.072]
1 = Swiss	0.507***	0.493***	0.171	0.160
	[0.185]	[0.189]	[0.119]	[0.115]
1 = Swiss father	0.099	0.100	-0.066	-0.066
	[0.100]	[0.098]	[0.050]	[0.050]
1 = Swiss mother	0.081	0.081	-0.118	-0.124
	[0.151]	[0.145]	[0.108]	[0.109]
Constant	-2.481***	-2.554***	-2.649***	-2.668***
	[0.088]	[0.107]	[0.192]	[0.176]
Observations	4555	4555	4998	4998
LogPseudoL	-4393.8903	-1433.2109	-6627.2148	-2185.9083
Pseudo R^2		0.1942		0.1086

The first four regressors are dummy variables for the age of onset of marijuana consumption (below age 14, between age 15 and 16, between age 17 and 18 and later for the regressions for tertiary education. The reference person is a male who has never smoked marijuana, has a low level of mastery and optimism, does not use sunscreen, does not state that health and nutrition are important to him, is not a Swiss citizen, has neither a Swiss mother nor a Swiss father, and lives in the region of central Switzerland in a municipality with less than 1000 inhabitants.

Data sources: Data on the cantonal-level availability of marijuana, measured as the number of drug trafficking delicts per capita at the time when the individual started to use marijuana, were taken from the Swiss Federal Statistical Office's Police Drug Statistics ("Polizeiliche Betäubungsmittelstatistik) since 1974. All other data are from the Swiss Health Survey (Schweizerische Gesundheitsbefragung), wave 2002.

We start the discussion of our results with the regressions in the first and second column, where the dependent variable takes the value of 1 if the individual has at least a secondary education, excluding the individuals with a tertiary education. In both regressions, the estimated coefficient on having started to smoke marijuana under age 14 is significantly negative. If the regional availability of marijuana and individual religiousness are indeed valid IVs for the age of onset of marijuana consumption, then the IV estimates in the second column suggest that this effect is causal and not due to unobserved heterogeneity. There is no significant effect for the onset of marijuana consumption between age 15 and 18.[4] These results suggest that early adolescence (i.e. before age 14) is indeed a critical period for onset of marijuana consumption. Onset of consumption below age 14 is a disinvestment in human capital, leading to lower probabilities of having at least a secondary education. It might be the case that the adolescent brain is especially vulnerable to the possible negative effects of marijuana consumption in this developmental period, leading to worse mnemonic skills and worse learning abilities and to resulting lower probabilities of finishing secondary education. While there seems to be little for neuropathology associated with marijuana use in adult users (Martin-Santos et al. 2010, Iversen 2003). However, evidence also seems to suggest that acute marijuana intoxication impairs short-term memory in adults (Iversen 2003), potentially leading to learning difficulties and, consequently, worse educational outcomes, and to different blood flow patterns in various areas of the brain, such as the hippocampus (Martin-Santos et al. 2010). None of these review studies focuses explicitly on adolescents and young adults whose brains still undergo significant changes.
Jacobus et al. (2009), however, provide a review of the literature in neurol-

[4]In the simple probit estimation, the estimated coefficient on onset of consumption between age 17 and 18 is positive, however, as this model does not take unobserved heterogeneity into account, this should not be interpreted as a causal effect.

ogy with a focus on adolescents. Marijuana use during a critical period of neural development may interrupt maturational processes, but it might also be the case that the developing brain is more resilient to neurotoxic effects. The findings most interesting to my research are possibly the ones related to the effects of marijuana on cognitive functioning in adolescents. There are two papers that focus explicitly on early-(i.e. before age 17) and later-onset marijuana users. Ehrenreich et al. (1999) use a sample of young adults and find that those who started to use marijuana before age 16, and still use it at least once a week, have worse scores on visual scanning than never-users. No such relationship is found for individuals who started to use marijuana after age 16. Pope et al. (2003) find that early onset (again, before age 17) is associated with worse performance, compared to never-users, on fluency, verbal memory, and verbal IQ after a 28-day controlled abstinence from marijuana use. Again, no such effect is found for those who started to use marijuana after age 16. These findings suggest that the adolescent brain before age 17 is indeed more vulnerable to adverse effects of marijuana use. The worse performance on the cognitive tasks mentioned before might provide an explanation why early marijuana users also perform worse in school and end up with a significantly lower probability of having at least a secondary education.

We now turn to the results for the probability of having a tertiary-level education, either vocational or university-based. Here, we do not find a significant relationship between different ages of onset of marijuana consumption and the probability of having a tertiary-level education. The results suggest that it is important to focus on the time period in youth when the individual started to use marijuana and to analyze the level of education, as the effects differ to a considerable degree. They also provide evidence for the existence of critical periods in the analysis of having finished at least a secondary education as an educational outcome, but these periods do not seem to exist when analyzing the probability of having finished a tertiary degree.

Labor Market Outcomes: Employment Probability

In a second estimation, we look at a measure of labor market success, namely, individual employment status. Of course, individual wages would also be an

interesting measure of labor market success, but as the Swiss Health Survey does not focus on labor market topics, it contains only information on the household's income. Hence, it would only be possible to calculate hourly wages for one-person households, which would reduce our sample drastically and probably result in a selected sample.

Again, cluster-robust standard errors are given in parentheses (clustering on region of origin). ***, **, and * denote significance levels of 1 %, 5%, and 10%, respectively. Complete estimation results including estimated coefficients on all control variables are provided in Appendix B.2.2.

Table 3.5: Unemployment probability: Regression Results

	unemployed mvprobit	unemployed probit
1 = compulsory schooling	-0.011	-0.010
	[0.123]	[0.121]
1 = secondary education	-0.246	-0.248
	[0.176]	[0.174]
1 = tertiary education	-0.030	-0.030
	[0.135]	[0.135]
1 = Marijuana under 14	0.718**	0.520**
	[0.315]	[0.220]
1 = Marijuana 15-16	0.292*	0.328**
	[0.160]	[0.163]
1 = Marijuana 17-18	0.125	0.206**
	[0.087]	[0.089]
1 = Marijuana over 18	0.274	0.251
	[0.200]	[0.154]
Age	0.017***	0.016***
	[0.004]	[0.004]
1 = Female	0.212**	0.216***
	[0.087]	[0.083]
1 = Married	-0.231***	-0.231***
	[0.044]	[0.044]
1 = Binge drinking	0.015	0.015
	[0.029]	[0.029]
1 = Body Mass Index	-0.019	-0.019
	[0.013]	[0.013]
1= High level of mastery	0.085	0.086
	[0.062]	[0.062]
1 = High level of optimism	-0.425***	-0.427***
	[0.083]	[0.081]
1 = Swiss	-0.043	-0.048
	[0.155]	[0.159]
1 = Swiss father	-0.126	-0.126
	[0.195]	[0.193]
1 = Swiss mother	-0.107	-0.109
	[0.117]	[0.113]
Constant	-0.697	-0.667
	[0.620]	[0.602]
Observations	4998	4998
Log PseudoL	-4857.9337	-400.90385
Pseudo R^2		0.1105

The first four regressors are dummy variables for the age of onset of marijuana consumption (below age 14, between age 15 and 16, between age 17 and 18 and later in life).

The reference person is a male school dropout who has never smoked marijuana, is not married, has not

had a binge drinking episode in the year before the interview, has a low level of mastery and optimism, does not use sunscreen, does not state that health and nutrition are important to him, is not a Swiss citizen, has neither a Swiss mother nor a Swiss father, and lives in the region of central Switzerland in a municipality with less than 1000 inhabitants.
Data sources: Data on the cantonal-level availability of marijuana, measured as the number of drug trafficking delicts per capita at the time when the individual started to use marijuana, were taken from the Swiss Federal Statistical Office's Police Drug Statistics ("Polizeiliche Betäubungsmittelstatistik) since 1974. All other data are from the Swiss Health Survey (Schweizerische Gesundheitsbefragung), wave 2002.

We start with a discussion of the results for the impact of different periods of onset in youth on the probability of being unemployed. Even after controlling for educational attainment, we find that respondents who have started to use marijuana before age 16 are significantly more likely to be unemployed. These results suggest that adolescence before age 16 is indeed a critical period for marijuana initiation with respect to labor market success in terms of Heckman's model. Early initiation into marijuana use does not only seem to be harmful for abilities that are essential for educational success, but also for skills that matter for labor market success. It could be the case, for example, that early marijuana consumption negatively affects personality traits such as grit and conscientiousness, which matter for success in the labor market in addition to educational qualifications.

3.5 Conclusion

The present paper provides an analysis of the impact of the age of marijuana initiation on educational and labor market outcomes. Following the concept of critical and sensitive periods for the development of human capabilities in a recent paper by Heckman (2007), we focused on different age periods of marijuana use onset, as there might be the possibility that some time periods of initiation are harmful, while others are not. We measured educational success as having finished at least a secondary education and as having finished a tertiary-level education instead of focusing on years of schooling as there is considerable evidence on "sheepskin effects" in returns to education, meaning that degrees have an additional signalling value on the labor market, and

having finished a degree is a prerequisite for many further education programs, while years of schooling do not matter. In addition, we also analyzed the impact of different ages of initiation on individual employment probability as a measure of labor market success. For the empirical analysis, we used the Swiss Health Survey 2002 (Schweizerische Gesundheitsbefragung), an unusually rich data set that combines information on educational background, health-related behavior and further individual- and regional-level background information. In order to deal with the possible endogeneity of marijuana use, we estimated a multivariate probit model and used an instrumental variables approach where we employed a regional supply-side instrument (the number of drug-related offences per capita at the time when the individual started to use marijuana) and an individual-level instrument (the individual's level of religiousness).

Our results suggest that there are indeed remarkable differences in effects for the different age periods of onset and for the different outcomes of interest. While onset of marijuana use under age 14 seems to decrease the probability of having at least a secondary-level education, we do not find a significant relationship between marijuana use and the probability of having a tertiary education. In terms of Heckman's model, these results suggest that early adolescence before age 14 is a critical period of marijuana use for having at least a secondary education as a human capital measure. Early marijuana use seems to be a disinvestment in human capital, meaning that it seems to destroy some abilities that would be needed in order to attain at least a secondary educational degree.

With respect to labor market success, we find that, even after controlling for educational attainment, individuals who have started to use marijuana before age 16 are significantly more likely to be unemployed. Initiation before age 16 seems to be a critical period for labor market success in terms of Heckman's model. It could be the case that marijuana use is harmful for the development of personality traits or abilities that matter for success in the labor market in addition to educational achievement, such as stamina and discipline.

There are, of course, several facts that might limit the validity of these find-

ings. First of all, these concern the empirical strategy, especially the instrumental variables. The crucial assumptions for being valid instruments for marijuana consumption is that they have to be uncorrelated with individual-level unobserved characteristics (e.g., time preference or ability) that are possibly driving both educational and drug consumption decisions and that they have to be correlated with individual-level marijuana consumption. While the first assumption is untestable, we think that it is not completely unreasonable to believe that it is true in our setup. We used a regional supply-side IV and a measure of individuals' self-reported religiousness. The regional IV consists of the canton-level number of drug-related accidents at the time when the individual started to use marijuana. This can be seen as a classical supply-side instrument. The underlying assumption for this being a valid IV is that an individual should be more likely to start smoking marijuana when the drug is more readily available, which should be the case when there are more drug-related accidents. At the same time, there is no reason to believe that there are differences across the different cantons with respect to ability or time preference as two candidate unobservables that might be driving both the decision to smoke marijuana and educational success. The measure of religiousness states on a scale from 1 to 7, where 1 means that the individual never attends religious services and 7 that he or she attends services every day. The assumption here is that more religious individuals should incur higher psychological costs of drug consumption and the probability of drug consumption should therefore decrease with their level of religiousness. Also, there is no evidence that there are differences with respect to time preference. Benjamin et al. (2009) do not find any effect of religious identity on time preference for individuals with different levels of religiousness.

As far as we know, the econometric literature does not provide any formal tests on instrument relevance or validity for nonlinear models with several endogenous variables. Following Koedel (2008), we ran a series of univariate probits and performed Likelihood Ratio tests in order to assess the relevance of our instruments. The Likelihood Ratio test rejected the hypothesis of instrument irrelevance at the 1%-level for onset of consumption aged 15 and 16 and aged 17 and 18 for both the regional and the individual-level religious-

ness instruments. The hypothesis of instrument irrelevance was rejected at the 5%-level for religiousness for those who started using marijuana below age 14, but it was not rejected for the regional availability for this age group. However, these univariate probit-based tests do not take into account that the instruments predict several endogenous regressors and hence they are only imperfect.

Secondly, there is the possibility that these results suffer from omitted variable bias: if, for example, adolescents with a certain social background are more likely to use marijuana early in life, their lower educational outcomes might be due to their lower social class and not only due to their early initiation into marijuana use.

Pedersen et al. (2001) use a Norwegian data set to analyze determinants of cannabis initiation among adolescents. In logistic regressions, they do not find any impact of socio-economic or other parental characteristics on the adolescents' probability of using marijuana. Siliquini et al. (2001) use a sample of Italian young men and find higher odds ratios of Cannabis use for individuals with higher levels of father's education. Von Sydow et al. (2002) use a sample of German adolescents and young adults in a longitudinal study to analyze the probability of uptake of cannabis use and do not find any association with socio-economic status, financial situation, parental attitudes towards medication/alcohol, alcohol problems of mother/father/other relatives, availability of alcohol at home, parental substance/medication use problem, siblings' problems with illicit substances, father affective/anxiety problem, mother anxiety problem, parental death before age 15. Pedersen (2009) uses the "Young in Norway Longitudinal Study", a representative sample of Norwegian adolescents, and finds no associations between working-class background or parental social marginality (unemployment/income from social welfare) and adolescent cannabis use. On the contrary, there was a positive association between cannabis use and high level of parental education (i.e. a university degree).

These findings suggest that there is no association between low parental social class and adolescents' probability of marijuana use. It might, however, still be the case that adolescents from low social class are more likely to

initiate into marijuana consumption early in life, leading to an overestimation of the true effect of early marijuana initiation on educational outcomes. Information on parental education or other proxies of social class, were it available in the data set, could help to rule out this possibility.

Also, information on intensity of marijuana consumption during youth and during apprenticeship training or university studies would be desirable. It might be the case, for example, that early marijuana users are more likely to use marijuana more often during the years after initiation (i.e. during their educational career). The lower probability of having at least a secondary education for those who started to use marijuana before age 14 might then be due not the early initiation, but to the higher intensity of marijuana use during the educational career of adolescents.

Future research in economics could include an analysis of the effects for differences in intensity or duration of past marijuana use. Also, longitudinal and more detailed data could offer the possibility to analyze in more detail the transmission channel for the effects that we have found. However, the Swiss Health Survey does not contain any information on intensity of past marijuana consumption. In addition, the lack of formal statistical tests for instrument validity and relevance in non-linear models like the multivariate probit model that we have used for the empirical analysis is of course a drawback. While natural experiments or quasi-experiments might provide more convincing statistical evidence on treatment effects, it is very difficult to think of such an experiment that might provide an opportunity to analyze the effects of the age of onset of marijuana consumption on educational outcomes.

In the next chapter, we are going to provide results for the impact of experimentally elicited preferences, ability and personality traits on individuals' decision-making abilities. We analyze sureness to graduate from apprenticeship training as an educational investment decision and see this sureness as the result of a decision-making process. As an additional robustness check, we also analyze the probability of smoking and drinking and see these outcomes as the results of poor decision-making skills. While the previous chapters have hypothesized about the impact of (mostly) unobservable characteris-

tics, the next chapter is going to explicitly introduce them into the empirical analysis of adolescent decision-making that might lead to risky educational and health investment decisions.

Chapter 4

Preferences, Personality and Human Capital Investment Decisions: First Results from a Field Experiment

4.1 Motivation

While human capital theory as pioneered by Gary Becker (1962) predicts that time preference should be a key determinant of human capital investment decisions, there has hardly been an empirical analysis of this prediction using experimentally elicited rates of time preference. One main reason for this surprising lack of research is probably the fact that most available data sets used by education economists do not contain any experimentally elicited information on typically unobservable characteristics, such as risk and time preference. In order to close this research gap, we combine experimentally elicited data on preferences and several psychological questionnaires with a longitudinal study design. Our research design consists of an incoming sample of Swiss "freshman" apprentices in three occupations. In several follow-ups, we are going to trace their outcomes over time in the following years in order to be able to carry out a causal analysis of preferences on educational

decisions.[1] Additionally, the study design will allow us to add evidence to the growing body of literature analyzing whether lab behavior predicts field behavior.

In this paper, we analyze the determinants of determination to graduate from apprenticeship training. We see determination to graduate as the result of a decision-making process and assume that individuals are confident about their graduation if they have used their decision-making ability to form expectations about the net present value (NPV) of their educational investment, and if they expect that this investment will result in a positive net present value. We assume that those who are unsure to graduate did not form expectations about the NPV of their investment in apprenticeship training, and that they have failed to do so due to their lack of decision-making abilities. We derive hypotheses on the relationship between personality traits, cognitive ability, economic preferences and the sureness to graduate as the result of decision-making ability and test those hypotheses empirically using our experimental data. As a robustness check, we also perform regressions for the determinants of the probabilities of smoking and binge drinking, seeing those activities as the results of poor decision-making abilities. Our results suggest that the determinants of the three outcomes differ to a considerable degree. For an individual's sureness to graduate, we find that "grittier" and more emotionally stable individuals are significantly more likely to be confident about their graduation. However, risk attitude and time preference do not significantly affect sureness to graduate. In the regressions for the determinants of the risky behaviors, smoking and bingeing, we find that risk averse individuals are significantly less likely to smoke. For the determinants of having had a binge drinking episode in the year before the experiment took place, we find that more conscientious and more agreeable individuals are significantly less likely to report a binge drinking episode. However, individuals with a higher level of cognitive reflection are significantly more likely to report that they had a binge drinking episode.

[1] This would not be possible, for example, using a sample of dropouts and graduates of apprenticeship training because it might be the case that dropping out changed the dropouts' preferences, or graduating changed the preferences of the graduates.

As in the regressions for the determinants of sureness to graduate, we do not find any correlation between economic preference parameters and the risky behavior of binge drinking. We attribute the difference in determinants due to the fact that these decisions are typically made in different settings and that different characteristics might be important in these settings. Decisions about apprenticeship training are typically the result of a long process that involves discussions with and guidance from adults, while the decision to smoke or to binge is typically the result of a spontaneous decision that takes place among peers and might involve social pressure.
The remainder of this essay is organized as follows. Part 4.2 presents theoretical considerations and testable hypotheses implied by these considerations, Part 4.3 describes the experimental procedures that we have used in order to elicit individual preferences, Part 4.4 presents the preliminary results, and Part 4.5 concludes and shows the possibilities for future research using this dataset.

4.2 Theoretical Considerations

The economic theory of human capital as pioneered by Becker (1962) suggests that a rational agent will invest in education (as in any other asset) only if it yields a positive net present value. Future costs and earnings streams can be discounted in order to make different alternatives comparable and to identify the optimal one. The following baseline model is taken from Johnes (1993). Let C_i denote the cost of a marginal education unit in time period i, and R_i the return associated with it. t is the duration of the individual's education, and T is the end of the individual's working life (e.g., his retirement). $i = 0$ is the base period where the individual decides whether to continue or not, and r denotes the interest rate used for calculation. A rational agent should then invest in education up to the point where his marginal return of education

equals the marginal cost:[2]

$$\int_0^t C_i e^{-ri} di = \int_t^T R_i e^{-ri} di \tag{4.1}$$

The net present value of the decision to invest in education is then given by

$$NPV = \int_t^T R_i e^{-ri} di - \int_0^t C_i e^{-ri} di \tag{4.2}$$

Ceteris paribus, the optimality condition implies that the investment will increase with the duration of the individual's working life (the time span between t and T) and with the returns to education, R. The level of education that the individual chooses decreases with the cost of education C and with the interest rate r, because a higher interest rate means that the individual is more impatient and values the future returns lower. These values can of course differ for different individuals.

Applied to the case of a decision to invest in apprenticeship, we get the following possible outcomes in terms of a binary decision:

$$apprenticeship = \begin{cases} 0 & \text{if} \quad \int_0^t C_i e^{-ri} di > \int_t^T R_i e^{-ri} di \\ 1 & \text{if} \quad \int_0^t C_i e^{-ri} di \leq \int_t^T R_i e^{-ri} di \end{cases} \tag{4.3}$$

We analyze individuals' surenesss to graduate from apprenticeship training. An individual should be sure to graduate if she or he expects a positive net present value of this educational investment. This condition requires that individuals have formed expectations about the costs and benefits of apprenticeship training, while those who are not sure to graduate probably have not formed those expectations yet. Their lack of having formed expectations might be due to missing information (e.g. about their chosen trade, about the training firm, about employment prospects after their graduation) or due to their poor decision-making skills, and they have probably entered apprenticeship training in order to gather the necessary information for being able to form expectations. The next section derives hypotheses about

[2]This is clearly a simplifying assumption, as it analyzes only marginal units of investment in education.

the relationship between personality traits, cognitive ability and sureness to graduate as a result of decision-making skills, partly based on research in psychology.[3]

We start with the relationship between cognitive ability and decision-making skills. An official taskforce of the American Psychological Association has defined cognitive ability as the "ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought" (Neisser et al. 1996). Psychological research suggests that cognitive ability and decision-making skills are positively correlated (see, for example, Stanovich and West 2000). Decision-making skills are usually measured as assessing beliefs, assessing values, combining beliefs and values in order to identify choices, and having and understanding of one's abilities (Edwards 1954, Raiffa 1968). Individuals with higher levels of cognitive ability should therefore more easily be able to form expectations about the NPV of their educational investment. Hence, we expect the following relationship between IQ and the sureness to graduate from apprenticeship training:

> H1: Ceteris paribus, individuals with higher cognitive ability should be more sure to graduate from apprenticeship training.

In addition to cognitive skills, some personality traits as measured by the Big Five inventory should also matter for an individual's decision-making skills and his or her resulting sureness to graduate from apprenticeship training. Those high in conscientiousness tend to be organized, thoughtful, and mindful of details, with good impulse control, and goal-directed behavior. These qualities should also translate into better decision-making abilities, as decision-making typically involves activities such as gathering relevant information as well as assessing corresponding probabilities and payoffs. More conscientious individuals should also exhibit the mentioned qualities in their decision-making, leading to better decision-making abilities and the following hypothesis:

[3]Surprisingly enough, research on decision-making in psychology has hardly analyzed the relationship between personality traits, cognitive ability, and decision-making skills.

> H2: Ceteris paribus, more conscientious individuals should be more sure to graduate from apprenticeship training.

Recent research by Duckworth et al. (2007) presents a scale measuring individuals' grit as another personality trait that they define as "perseverance and passion for long-term goals" and as an essential predictor of individual success other than intellectual ability. Their results seem to suggest that grit is indeed a significant success predictor. Grittier individuals are probably also more likely to be gritty in their decision-making behavior, resulting in gathering more relevant information and, consequently, better decisions. We included the Grit score in our regressions and posit the following hypothesis:

> H3: Ceteris paribus, individuals with higher Grit scores should be more sure to graduate from apprenticeship training.

The Cognitive Reflection Test is a short (3 item) scale developed by Frederick (2005), who describes cognitive reflection as "the ability or disposition to resist reporting the response that first comes to mind". This ability should also help in decision-making when evaluating alternatives, and leads to the following hypothesis:

> H4: Ceteris paribus, individuals with higher cognitive reflection scores should be more sure to graduate from apprenticeship training.

The last two hypotheses deal with the relationship between economic preference parameters and decision-making ability. More patient individuals should value future returns of decisions more, hence they should also be willing to invest more time in decision-making. This leads to the following hypothesis on the relationship between discount rates and decision-making:

> H5: Ceteris paribus, more patient individuals with consistent rates of discounting should be more sure to graduate from apprenticeship training.

Finally, less risk-averse individuals should probably be less affected by a higher variance in the outcomes of their decisions due to their lack of decision-making effort. Hence, we expect the following relationship between risk attitude and determination to graduate:

> H6: Ceteris paribus, individuals with higher degrees of risk aversion should be more sure to graduate from apprenticeship training.

The next section describes in more detail how the data for testing these hypotheses were gathered in experimental sessions.

4.3 Experimental Design

4.3.1 Procedures

Data were collected during schooltime in the second, third and fourth week of the school year with an incoming cohort of new apprentices in three different schools (in Uster, Winterthur and Zurich). As school attendance is mandatory for apprentices, any participation bias seems unlikely. Apprentices from three different occupations (business assistants, electricians and polytechnicians) took part in the experiment. In total, our data set includes information on 265 participants.[4]

The experiment took place in classrooms during a normal school day in a paper-and-pencil format. First, the apprentices answered a questionnaire containing items on their individual background, for example parental education, hobbies, friends and family structure. This questionnaire also contained a 15-item German language short version of the Big Five inventory (Gerlitz and Schupp 2005), the Cognitive Reflection Test (Frederick 2005) and the Grit score inventory (Duckworth et al. 2007). The second part was a sub-module of an IQ test and the last part of the experiment consisted of four choice questions in order to elicit subjects' risk and time attitude.

[4]Due to missing information, the number used in the empirical analyses is slightly lower with 218 individuals.

Compared to all apprentices in Switzerland, our sample differs in some key points. The first point is gender composition. According to the Swiss Federal Statistical Office's "Statistics of Pupils and Students" (Bundesamt fuer Statistik, Statistik der Schueler und Studierenden), in 2008, 54.9% of all incoming apprentices were male, compared to 60.4% in our sample. Data for 2009, the year in which our experiment took place, are not available yet. With respect to the occupation chosen, 93.8% of all apprentices in Switzerland in technical and engineering apprenticeships (including electricians and polymechanics) are male, compared to 100% in our sample. In Business and administration (including business assistants), 38.9% are male, compared to 34.8% in our sample. Hence, men are slightly over-represented in our sample on the whole and among the technical occupations, and slightly under-represented in the business assistant occupation.

The second point is the fact that we only have apprentices from three occupations. Business assistant was the most frequently chosen occupation in Switzerland in 2003, where 19.3% of all apprentices chose this occupation. Unfortunately, more recent data are not available. While 3.7% of all apprentices chose the occupation of electrician, and 3.1% chose to become polymechanics in the field of engineering and technical occupations, we do not have any apprentices in the fields of arts, computer science, manufacturing, construction and architecture, agriculture, health occupations, and personal services.

The third point concerns the previous level of education of the freshmen apprentices. Compared to all apprentices in Switzerland in 2008, the members of our sample have more often finished 9 years of schooling (78.1% vs. 72.2% in all of Switzerland) and more often finished 10 years of schooling (18.1% vs. 13.8% in all of Switzerland). However, they have less often finished another education on secondary or tertiary level, compared to all of Switzerland (vs. 0.75% vs. 14.0% in all of Switzerland).

In order to measure subjects' risk and time preference, we used incentivized experiments. Subjects received an initial amount of 10 Swiss francs in order to avoid losses (the choice questions also included a question aiming at eliciting loss aversion). The full script and instructions used in the experiments

(in German) are presented in Appendix C.3.
In all experimental sessions, the experimenter explained the choice questions, how payments would be carried out, and how the relevant decisions for payments would be determined. For the gamble questions, one row would be randomly selected for payment for every participant. For the time preference questions, two participants would be picked randomly for payment, and subjects were not told until after the experiment which participants were chosen. In the intertemporal choice questions, the payment would again be determined by randomly selecting one row from the corresponding choice sheet, but only the picked subjects were actually paid. Randomly picking rows for payments incentivizes subjects to choose according to their true preferences in each choice problem. Subjects were also informed that they would receive the payments from the risk questions, as well as payments from the intertemporal choice questions if they preferred the immediate payment, immediately after the experimental session. Finally, they were also informed that all future payments would be sent by certified mail at the respective time in the future, in the form of a cash payment, and those who were drawn for the future payments received a letter of guarantee on the day of the experiment in order to ensure credibility.

4.3.2 Lotteries and Discounting Choices

We elicited subjects' risk attitude using choices between a paid lottery and safe payments. Participants made choices in a choice sheet with 10 rows, and in each row they had to decide whether they preferred a safe option (the certainty equivalent) or playing the lottery. In the lottery they could win either 10 Swiss francs or 0 Swiss francs, with a probability of 50 percent each. The lottery did not change for the different rows, but the amount that participants would receive if they chose the safe option would increase from row to row (from 1 swiss franc to 10 Swiss francs). Upper and lower bounds for individuals' degree of risk aversion can then be calculated assuming a functional form for their utility function (such as constant relative risk aversion, CRRA) and using the safe options from the switching row and the

previous row in the experiment.[5]

The second choice question asked subjects to choose between a lottery where they could either win or lose a certain amount or a second option where nothing would happen in order to test for loss aversion (Kahneman and Tversky 1979). The lottery in the first row had a 50 percent probability of winning 6 Swiss francs and a 50 percent probability of losing 2 Swiss francs. For each of the 5 following rows, the amount that subjects would lose in the loss case increased by one Swiss franc so that in the last row, the lottery had a 50 percent probability of winning 6 Swiss francs or losing 7 Swiss francs.

For measuring subjects' time preference rates, we created two more choice sheets with 20 rows for choices between receiving payments at different times. Again, subjects were asked to make choices in each row of a decision sheet. In the first intertemporal choice question, the choice was between 100 Swiss francs in 3 months and a smaller amount X that subjects would be paid immediately. The size of the immediate payment X increased by 5 Swiss francs in each row, starting from a value of 5 Swiss francs in the first row up to a value of 100 Swiss francs in the 20th row. In the second time preference question, subjects were asked to choose between 100 Swiss francs in 6 months and the same amounts as in the first time preference question in 3 months (between 5 Swiss francs and 100 Swiss francs) in order to detect time inconsistent choices. Bounds of individuals' degree of time preference can then be calculated using the immediate payments from the switching row and the row before.[6]

4.3.3 Psychological Questionnaires

In addition to the background questions, the first part of the study contained also two psychological questionnaires on personality traits (the Big 5 inventory and the Grit inventory), the Cognitive Reflection test (CRT) and the

[5]The individual degree of risk aversion is then given by $\gamma = 1 - ln(p)/[ln(y) - ln(x)]$, where p denotes the winning probability in the choice lottery, y denotes the safe option, and x denotes the winning payment from the lottery.

[6]Bounds for the individual's degree of time preference r are then be given by $1 + r = \sqrt[3]{(y/x)}$, where r denotes time preference, y denotes the future payment, and x denotes the immediate payment.

Symbol Correspondence Test, a submodule from the HAWIE-R intelligence test.

The Big Five are five dimensions which define human personality at the broadest level (Goldberg 1993). While research on the topic dates back to the 1930s in personality psychology, economists have only very recently discovered the predictive power of personality traits for economic outcomes and their potential for economic research (Borghans et al. 2008). For measurement of the personality dimensions (Openness to experience, Conscientiousness, Extraversion, Agreeableness and Emotional Stability), we used the 15-item short version of the Big Five inventory that was developed and validated for usage in the German Socio-Economic Panel (Gerlitz and Schupp 2005). See Appendix C.3 for the items used (in German).

The Grit inventory was developed by Duckworth et al. (2007) in order to measure individuals' grit as another personality trait that they define as "perseverance and passion for long-term goals" and as an essential predictor of individual success other than intellectual ability. They validated the Grit scale using six completely different samples of participants and measures of success (educational attainment for two adult samples, grade point average for one sample of Ivy League undergraduates, retention within the program for two cohorts of West Point cadets and final round participation for a sample of National Spelling Bee competition finalists). Their results suggest that the Grit scale is on the one hand uncorrelated with IQ and on the other hand always a significant predictor of their success measures. We use the resulting score from their scale (where items were translated to German) as an additional possible predictor of educational outcomes. Again, the items used can be found in Appendix C.3.

The Cognitive Reflection Test is a short (3 item) scale developed by Frederick (2005). It consists of three questions that look simple and are easily understood once explained, however, they all have an "intuitive" answer that is wrong. The CRT can be seen as a measure of how likely it is that individuals do think twice about problems that are seemingly easy and intuitive, and their willingness to provide attention and cognitive effort to this type of question. Frederick (2005) describes the test as "the ability or disposition to

resist reporting the response that first comes to mind". In his study, he finds that those with three correct answers to the CRT are more patient and less risk averse than those with no correct answers.
Following recent results by Falk et al. (forthcoming), we also included measures on cognitive ability into our classroom sessions. We took the symbol correspondence test from the German language version of the Wechsler Adult Intelligence Scale (WAIS), which is known as the "Hamburg-Wechsler Intelligenztest für Erwachsene" (HAWIE-R), one of the most widely used intelligence tests worldwide. While including only one submodule is certainly not the perfect way to measure cognitive ability, previous research has shown that scores on these submodules are highly correlated with scores on other submodules of the WAIS and of other widely-used intelligence tests (Lang et al. 2005, Lang et al. 2007).
The symbol correspondence test presents subjects with nine symbols that are paired with one of the numbers 1 through 9. In the paper-pencil based version of the test that we used, subjects received a series of numbers and had to fill in as many of the corresponding symbols as possible during 120 seconds. The resulting number of correct answers was used as a measure of cognitive ability.
In the next section, we present descriptive statistics and regression results.

4.4 Results

4.4.1 Descriptive Statistics

The following section provides some basic descriptive features of the data set. Complete summary statistics for the other variables of interest are provided in Appendix C.1.
The vast majority of subjects (78.11%) has completed nine years of schooling before starting their apprenticeship training. Another 18.11% have completed 10 years of schooling, which is usually only done by students who do not find an apprenticeship place immediately after 9 years of schooling, and

only 0.75% have finished their previous schooling career with a university-entrance diploma, corresponding to 12 years of schooling. The other 3.02% have pursued another activity before starting their apprenticeship, for example an internship or an au pair stay abroad.

Table 4.1: Previous level of schooling

	Frequency	Percentage
9 years	207	78.12%
10 years	48	18.11%
University entrance diploma	2	0.75%
Other	8	3.02%
Total	265	100%

There are 60.38% of males and 39.62% of females in the sample. While there is no female apprentice in the technical occupations (electricians and polytechnicians) in our sample, females account for 65.22% of all business assistant apprentices.

Table 4.2: Gender and occupations

	Male	Female	Total number of apprentices
Business	34.78%	65.22%	161
Electricians	100%	0	52
Polytechnicians	100%	0	52
Total	60.38%	39.62%	265

We next turn to descriptive results for the psychological background variables.

The results in our sample confirm the findings for the cognitive resonance test (CRT) from Frederick (2005) that "these items measure something that men have more of". None of the female subjects provided the correct answer to all three items of the CRT, and the mean value for females is roughly half the mean value of males (the difference in means is statistically significant at the 1% - level). The participants in Frederick's (2005) original study were college students at various universities in the United States. Compared to

them, our sample of apprentices performed at the lower end of the distribution. MIT students had an average score of 2.18, Princeton students a score of 1.63, and Michigan State University students a score of 0.79, similarly to our sample. As Frederick found that individuals with a higher CRT score are more patient and less risk averse, we expect to find a similar relationship in our study.

Table 4.3: Gender, Occupations and CRT

	Mean	Standard Deviation	Minimum	Maximum
CRT, entire sample	0.8038	0.9248	0	3
CRT, males	1	0.9969	0	3
CRT, females	0.5048	0.7088	0	2

Interestingly, females scored significantly higher on the symbol correspondence test (SCT, the submodule of the HAWIE-R intelligence test that we used as a measure of cognitive ability) in our sample. For example, Heineck (2009) does not find any gender differences on SCT scores in the German Socio-economic Panel (GSOEP).

Table 4.4: Gender, Occupations and SCT

	Mean	Standard Deviation	Minimum	Maximum
SCT, entire sample	75.8784	12.1369	45	116
SCT, males	72.2450	11.0266	45	106
SCT, females	81.1539	11.7785	53	116

Given the fact that we carried out our experimnt very early in the apprenticeship year, it is not surprising to see that most apprentices are still very motivated and sure about their decision and exhibit a high sureness to graduate from apprenticeship training.

Table 4.5: Sure to finish: Gender and Occupations

	Mean	Standard Deviation
sure to finish	0.8906	0.3128
sure to finish, male	0.8750	0.3318
sure to finish, female	0.9143	0.2813

In the next section, we are going to present regression results in order to empirically test the hypotheses that we have derived in Section 2.

4.4.2 Regression Results: Sureness to graduate

In order to test the hypotheses that we have derived in section 2, we ran a series of probit regressions of the following estimation equation.

$$outcome_i = \alpha + \beta iq_i + \gamma big5_i + \delta grit_i + \zeta crt_i + \eta timepref_i + \theta riskatt_i + \iota X_i + \epsilon_i \tag{4.4}$$

The dependent variable is a dummy variable that takes the value of 1 if the respondent has stated that he or she is "very sure" or "rather sure" to graduate from apprenticeship training. For the robustness checks in the next section, the dependent variable takes the value of 1 if the respondent smokes or has reported a binge drinking episode in the year before the experiment. In addition to the regressors of interest (cognitive ability as measured by the score on the symbol correspondence test, iq_i, personality traits, $big5_i$ and $grit_i$, the level of cognitive reflection, crt_i, time preference rates in the discounting choices, $timepref_i$, and risk attitude, $riskatt_i$), we also included a host of control variables, X_i. These include subjects' gender, previous level of schooling, age, personality traits, whether they are born in Switzerland, their occupation, parental education, whether their parents are divorced, how hard it is for them to raise 100 CHF for personal spending as an income measure, the percentage of their friends who are also in school or apprenticeship training, how many applications they had submitted to get their apprenticeship place, and their number of siblings.

The following table presents results from simple probit regressions. Standard errors are given in parentheses, ***, **, and * denote significance levels of 1 %, 5%, and 10%, respectively. Complete regression results, including estimated coefficients on all the control variables, can be found in Appendix C.2.1. Not all observations could be used in the regression analysis because some regressors perfectly predicted the dependent variable, meaning that only one value of a regressor was associated with only one value of the

dependent variable, leading to a smaller sample size than the original 265 observations.

Table 4.6: Regression results: Determinants of sureness to graduate

	Model I	Model II	Model III	Model IV	Model V	Model VI
CRT score	0.143	0.057	0.180	0.155	0.189	0.221
	[0.251]	[0.261]	[0.260]	[0.245]	[0.257]	[0.306]
IQ score	-0.005		-0.004	-0.004	-0.006	-0.008
	[0.011]		[0.011]	[0.010]	[0.011]	[0.011]
Grade German		0.290				
		[0.691]				
Grade English		0.037				
		[0.359]				
Grade Math		0.523				
		[0.429]				
Grit score	0.952*	0.963*	0.745**	-0.114	0.781**	0.596
	[0.487]	[0.503]	[0.332]	[0.382]	[0.387]	[0.483]
1 = risk averse	-0.435	-0.393	-0.576	-0.430	-0.437	
	[0.487]	[0.476]	[0.513]	[0.462]	[0.482]	
1 = risk loving	0.900	1.163*	0.855	0.942	1.035*	
	[0.585]	[0.675]	[0.601]	[0.593]	[0.602]	
γ						-0.054
(coeff. of risk aversion)						[0.152]
Switchpoint in discounting	0.005	0.004	0.004	0.006	0.006	0.000
	[0.010]	[0.010]	[0.011]	[0.010]	[0.010]	[0.010]
Big Five:	-0.006	-0.009	0.008	0.007	-0.009	-0.015
Openness	[0.021]	[0.022]	[0.021]	[0.022]	[0.021]	[0.022]
Big Five:	-0.036	-0.034	-0.027	-0.030	-0.042	-0.050
Conscientiousness	[0.035]	[0.037]	[0.036]	[0.035]	[0.037]	[0.038]
Big Five:	-0.015	-0.005	-0.012	-0.026	-0.017	-0.028
Extraversion	[0.028]	[0.029]	[0.028]	[0.028]	[0.029]	[0.032]
Big Five:	0.028	0.042	0.018	0.020	0.033	0.024
Agreeableness	[0.029]	[0.032]	[0.030]	[0.028]	[0.030]	[0.029]
Big Five:	0.089**	0.096**	0.102***	0.078**	0.090**	0.090***
Emotional Stability	[0.035]	[0.037]	[0.038]	[0.033]	[0.036]	[0.034]
number of applications	-0.011*	-0.013*	-0.011	-0.009	-0.012*	-0.006
for apprenticeship place	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.006]
friends in school	2.418**	2.143*	2.762**	2.991***	2.822**	3.403***
or training	[1.128]	[1.198]	[1.160]	[1.150]	[1.097]	[1.307]
parents divorced	0.112	0.458	0.238	0.041	-0.001	0.345
	[0.534]	[0.605]	[0.547]	[0.499]	[0.539]	[0.565]
number of siblings	-0.753***	-0.835***	-0.806***	-0.732***	-0.763***	-0.631***
	[0.225]	[0.245]	[0.237]	[0.221]	[0.230]	[0.219]
Constant	-1.433	-6.004	-1.385	1.909	-1.226	0.548
	[5.480]	[7.192]	[5.487]	[5.196]	[5.412]	[5.550]
Observations	211	211	211	211	211	170
Pseudo R^2	0.4508	0.4658	0.4654	0.4173	0.4542	0.3787
Log L	-33,7865	-32,8606	-32,8855	-35,8478	-33,5745	-32,9501

Notes: CRT score denotes the score on the cognitive reflection test, IQ score denotes the score on the submodule of the IQ score that we used as a measure of cognitive ability, the grades in German, Math and English are subjects' self-reported grades in those subjects in the last year of school before entering apprenticeship training, Grit score denotes the individuals's score on the Grit test and the two subscores for perseverance of effort and consistency of interest, "risk averse" and "risk loving" are two dummy variables

that take the value of 1 if the individual is risk averse or risk loving, respectively. γ denotes the coefficient of relative risk aversion calculated assuming a constant relative risk aversion utility function. Switchpoint in discounting denotes our measure of time preference, the point at which an individual switched from the delayed payment in three months to the immediate payment. The following five variables denote the individuals' score on the Big Five dimensions. The next variable is the number of applications that the individual has submitted for his or her apprenticeship place. "Friends in school or training" is the percentage of the individuals' friends in those two activities as opposed to being unemployed or working as an unskilled worker. "Parents divorced" is a dummy variable that takes the value of 1 if the respondents' parents are divorced. In addition, the regressions include control variables for an individuals' self-stated difficulty of raising 100 CHF as an income measure, gender, whether the respondent was born in Switzerland, age, previous level of schooling, the occupation, and both parents' level of education.

While Model I and Models III -VI use the IQ score as a measure of cognitive abilty, Model II uses school grades in German, English and Mathematics. Models III, IV and V use three subscales of the Grit scale (Consistency of Interest, Perseverance of Effort, and Ambition, respectively) instead of the full scale. Finally, Model VI does not use two dummy variables for being risk averse or risk loving, but γ, the coefficient of relative risk aversion assuming CRRA utility.

We now turn to the discussion of the results. Hypothesis 1 stated that, ceteris paribus, individuals with higher cognitive ability should be more sure to graduate from apprenticeship training because of their better decision-making abilities. However, we do not find a significant impact of IQ score on individuals' sureness to graduate from apprenticeship training. Cognitive ability does not seem to be associated with education-related decision-making skills.

The next hypothesis, H2, stated that ceteris paribus, more conscientious individuals should be more sure to graduate from apprenticeship training. While we do not find a significant impact of the other four Big Five personality traits, more emotionally stable individuals are indeed more likely to be sure about their graduation from apprenticeship training in all regressions. This finding could be due to a higher confidence of more emotionally stable individuals in all fields of life, including decision-making.

H3 stated that, ceteris paribus, individuals with higher grit scores should be more sure to graduate from apprenticeship training. Here, we find indeed

that individuals with higher scores on the grit scale are significantly more likely to state that they are either rather sure or very sure to graduate from apprenticeship training. We also used the three subscales of the grit score in Model III (Consistency of Interest), IV (Perseverance of Effort) and V (ambition). While the Consistency of Interest and the Ambition scales as two subscales also show a significantly positive impact on an individual's sureness to graduate, the Perseverance of Effort scale did not show any significant impact on the dependent variable. Hence, we cannot reject the hypothesis that grittier individuals are better decision-makers and therefore more sure to graduate from apprenticeship training.

The next hypothesis, H4, stated that, ceteris paribus, individuals with higher CRT scores should have better decision-making abilities, resulting in higher levels of sureness to graduate. Again, there is no statistically significant relationship between this regressor and the sureness to graduate.

Our last two hypotheses stated the possible impact of economic preferences on educational investment decisions. H5 posited that ceteris paribus, more patient individuals should be more sure to graduate from apprenticeship training. We do not find a significant effect of this variable on the probability of stating to be rather or very sure to graduate from apprenticeship training.

Finally, H6 stated that, ceteris paribus, individuals with higher degrees of risk aversion should be more sure to graduate from apprenticeship training. However, in none of the regressions, individuals' risk attitude showed a significant impact of stated sureness about graduating from apprenticeship training.

In addition to these findings, there is one especially interesting relationship. The higher the percentage of friends in school, apprenticeship training or an employment relationship after graduation from apprenticeship training of an individual among all friends is (as opposed to friends who are unemployed or working as unskilled workers), the more likely it is that he or she is sure about graduating from apprenticeship training. One candidate explanation is that those individuals who have educational role models in their peer group are more likely to be sure about their own educational success. If it is the

standard in a peer group to complete training and work as a skilled worker afterwards, the psychological costs of dropping out are probably considerably higher than in a peer group where there are many unemployed individuals or unskilled workers among one's friends.

4.4.3 Regression Results: Risky Behaviors

In the next section, we present robustness checks for the relationship between our regressors of interest and the decisions to smoke and to binge, respectively. Viscusi (1992) reports that 99% of 13-14 year old children in the US knew that smoking can cause cancer, and more than 75% knew about the addictive potential of smoking. As the risks of smoking and drinking excessively are well-known due to preventive measures and campaigns in schools, the decision to smoke or to binge can be seen as the result of poor decision-making abilities.

Here, the control variables include subjects' gender, previous level of schooling, age, personality traits, whether they were born in Switzerland, parental education, whether their parents are divorced, how hard it is for them to raise 100 CHF for personal spending as an income measure, and their number of siblings.

The following table presents results from probit regressions. Standard errors are given in parentheses, ***, **, and * denote significance levels of 1 %, 5%, and 10%, respectively. Complete regression results, including estimated coefficients on all the control variables, can be found in Appendix C.2.1. Not all observations could be used in the regression analysis because some regressors perfectly predicted the dependent variable, leading to a smaller sample size than the original 265 observations.

Table 4.7: Regression results: Determinants of the decision to smoke

	Model I	Model II	Model III	Model IV	Model V	Model VI
CRT score	0.033	0.111	0.037	0.037	0.033	-0.005
	[0.119]	[0.123]	[0.118]	[0.118]	[0.120]	[0.122]
IQ score	0.004		0.004	0.004	0.004	0.004
	[0.006]		[0.006]	[0.006]	[0.006]	[0.006]
Grade German		-0.441				
		[0.286]				
Grade English		-0.013				
		[0.188]				
Grade Math		-0.395**				
		[0.176]				
Grit score	-0.266	-0.240	-0.015	-0.068	-0.410**	-0.357
	[0.227]	[0.234]	[0.144]	[0.193]	[0.171]	[0.229]
1 = risk averse	-0.454*	-0.463*	-0.486*	-0.483*	-0.434*	
	[0.254]	[0.260]	[0.252]	[0.252]	[0.256]	
1 = risk loving	-0.336	-0.409	-0.353	-0.353	-0.315	
	[0.254]	[0.260]	[0.253]	[0.253]	[0.257]	
γ						-0.082
(coeff. of risk aversion)						[0.106]
Discounting switchpoint	0.004	0.007	0.004	0.004	0.004	0.004
	[0.005]	[0.006]	[0.005]	[0.005]	[0.005]	[0.005]
Big Five:	-0.002	0.003	-0.006	-0.004	0.003	-0.001
Openness	[0.012]	[0.012]	[0.011]	[0.012]	[0.012]	[0.012]
Big Five:	-0.011	-0.009	-0.013	-0.012	-0.008	-0.016
Conscientiousness	[0.015]	[0.016]	[0.015]	[0.016]	[0.015]	[0.016]
Big Five:	0.025*	0.025*	0.026*	0.026*	0.028*	0.023
Extraversion	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
Big Five:	-0.001	-0.007	0.001	0.001	-0.003	-0.002
Agreeableness	[0.015]	[0.015]	[0.014]	[0.014]	[0.015]	[0.015]
Big Five:	0.017	0.018	0.018	0.019	0.015	0.017
Emotional Stability	[0.015]	[0.016]	[0.015]	[0.015]	[0.016]	[0.015]
parents divorced	0.776***	0.792***	0.772***	0.775***	0.804***	0.743***
	[0.247]	[0.255]	[0.246]	[0.246]	[0.249]	[0.247]
number of siblings	-0.042	-0.050	-0.063	-0.059	-0.046	-0.021
	[0.118]	[0.121]	[0.117]	[0.117]	[0.117]	[0.121]
difficulty of raising 100 CHF	0.062	0.117	0.060	0.062	0.030	0.074
	[0.104]	[0.109]	[0.104]	[0.104]	[0.106]	[0.106]
Constant	-0.912	2.717	-1.729	-1.662	-0.354	-1.586
	[3.129]	[3.369]	[3.104]	[3.063]	[3.095]	[3.121]
Observations	218	218	218	218	218	214
Pseudo R^2	0.1600	0.1951	0.1551	0.1555	0.1764	0.1555
Log L	-116,1665	-111,3084	-116,8505	-116,7942	-113,8956	-113,6219

Notes: CRT score denotes the score on the cognitive reflection test, IQ score denotes the score on the submodule of the IQ score that we used as a measure of cognitive ability, the grades in German, Math and English are subjects' self-reported grades in those subjects in the last year of school before entering apprenticeship training, Grit score denotes the individuals's score on the Grit test and the two subscores for perseverance of effort and consistency of interest, "risk averse" and "risk loving" are two dummy variables that take the value of 1 if the individual is risk averse or risk loving, respectively. γ denotes the coefficient of relative risk aversion calculated assuming a constant relative risk aversion utility function. Switchpoint in discounting denotes our measure of time preference, the point at which an individual switched from the delayed payment in three months to the immediate payment. The following five variables denote

the individuals' score on the Big Five dimensions. The next variable is the number of applications that the individual has submitted for his or her apprenticeship place. "Friends in school or training" is the percentage of the individuals' friends in those two activities as opposed to being unemployed or working as an unskilled worker. "Parents divorced" is a dummy variable that takes the value of 1 if the respondents' parents are divorced. In addition, the regressions include control variables for an individuals' self-stated difficulty of raising 100 CHF as an income measure, gender, whether the respondent was born in Switzerland, age, previous level of schooling, the occupation, and both parents' level of education.

Again, Model I and Models III -VI use the IQ score as a measure of cognitive abilty, while Model II uses school grades in German, English and Mathematics. Models III, IV and V use three subscales of the Grit scale (Consistency of Interest, Perseverance of Effort, and Ambition, respectively) instead of the full scale. Finally, Model VI does not use two dummy variables for being risk averse or risk loving, but γ, the coefficient of relative risk aversion assuming CRRA utility.

We now turn to the discussion of the results. Hypothesis 1 stated that, ceteris paribus, individuals with higher cognitive ability should have better decision-making abilities and hence be less likely to smoke. However, we only find math grades to be significantly negatively correlated with an individual's probability to smoke.

The next hypothesis, H2, stated that ceteris paribus, more conscientious individuals should have better decision-making skills. As in the previous regressions, we do not find a significant relationship between conscientiousness and the dependent variable.

H3 stated that, ceteris paribus, individuals with higher grit scores should have better decision-making skills. For the determinants of smoking, we only find a significant relationship when using the Ambition subscale of the Grit score. H4 posited that individuals with a higher level of cognitive reflection should be less likely to be smokers, but again, there is no significant relationship between the two variables.

Our last two hypotheses stated the possible impact of economic preferences on educational investment decisions. H5 posited that ceteris paribus, more patient individuals should be more confident to graduate from apprenticeship training. We do not find a significant effect of this variable on the probability of stating to be rather or very sure to graduate from apprenticeship training.

Finally, H6 stated that, ceteris paribus, individuals with higher degrees of risk aversion should have better decision-making skills. We used the same measures as in the regressions for sureness to graduate, but for the decision to smoke, we find indeed that risk averse individuals are significantly less likely to smoke.

As for the control variables, we find that more extrovert individuals are significantly more likely to smoke. This finding might be due to the fact that more extrovert individuals are more likely to participate in social activities where they get in contact with smokers and end up smoking themselves.

As a last robustness check, we present regressions for the probability of having had a binge drinking episode during the year before the experiment. Again, we use the same control variables as in the regressions for individuals' probability to smoke.

Table 4.8: Regression results: Determinants of the decision to binge

	Model I	Model II	Model III	Model IV	Model V	Model VI
CRT score	0.321***	0.377***	0.318***	0.330***	0.318***	0.361***
	[0.116]	[0.120]	[0.116]	[0.116]	[0.116]	[0.122]
IQ score	0.001		0.001	0.001	0.000	0.001
	[0.005]		[0.005]	[0.005]	[0.005]	[0.005]
Grade German		-0.248				
		[0.280]				
Grade English		-0.018				
		[0.181]				
Grade Math		-0.303*				
		[0.182]				
Grit score	-0.360	-0.315	0.002	-0.394**	-0.346**	-0.458**
	[0.226]	[0.229]	[0.141]	[0.197]	[0.175]	[0.228]
1 = risk averse	-0.380	-0.366	-0.412	-0.402	-0.378	
	[0.259]	[0.263]	[0.258]	[0.257]	[0.261]	
1 = risk loving	-0.431*	-0.482*	-0.443*	-0.456*	-0.440*	
	[0.255]	[0.259]	[0.255]	[0.256]	[0.257]	
γ						-0.004
(coeff. of risk aversion)						[0.108]
switchpoint in discounting	-0.004	-0.002	-0.004	-0.003	-0.004	-0.004
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Big Five:	0.007	0.010	0.001	0.011	0.009	0.006
Openness	[0.012]	[0.012]	[0.011]	[0.012]	[0.012]	[0.012]
Big Five:	-0.046***	-0.046***	-0.048***	-0.043***	-0.046***	-0.053***
Conscientiousness	[0.016]	[0.017]	[0.016]	[0.017]	[0.017]	[0.017]
Big Five:	-0.015	-0.019	-0.014	-0.013	-0.013	-0.018
Extraversion	[0.014]	[0.015]	[0.014]	[0.015]	[0.015]	[0.015]
Big Five:	-0.031**	-0.037**	-0.026*	-0.031**	-0.033**	-0.031**
Agreeableness	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
Big Five:	0.021	0.022	0.022	0.025	0.021	0.022
Emotional Stability	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
parents divorced	0.311	0.284	0.310	0.328	0.318	0.390
	[0.255]	[0.258]	[0.253]	[0.255]	[0.255]	[0.260]
number of siblings	-0.161	-0.168	-0.187*	-0.155	-0.185	-0.110
	[0.114]	[0.115]	[0.114]	[0.114]	[0.113]	[0.117]
difficulty of raising 100 CHF	0.103	0.138	0.093	0.119	0.083	0.084
	[0.102]	[0.107]	[0.102]	[0.103]	[0.103]	[0.103]
Observations	218	218	218	218	218	214
Pseudo R^2	0.1786	0.1950	0.1700	0.1837	0.1834	0.1802
Log L	-123,2077	-120,7514	-124,4898	-122,4338	-122,4806	-120,6818

Notes: CRT score denotes the score on the cognitive reflection test, IQ score denotes the score on the submodule of the IQ score that we used as a measure of cognitive ability, the grades in German, Math and English are subjects' self-reported grades in those subjects in the last year of school before entering apprenticeship training, Grit score denotes the individuals's score on the Grit test and the two subscores for perseverance of effort and consistency of interest, "risk averse" and "risk loving" are two dummy variables that take the value of 1 if the individual is risk averse or risk loving, respectively. γ denotes the coefficient of relative risk aversion calculated assuming a constant relative risk aversion utility function. Switchpoint in discounting denotes our measure of time preference, the point at which an individual switched from the delayed payment in three months to the immediate payment. The following five variables denote the individuals' score on the Big Five dimensions. The next variable is the number of applications that

the individual has submitted for his or her apprenticeship place. "Friends in school or training" is the percentage of the individuals' friends in those two activities as opposed to being unemployed or working as an unskilled worker. "Parents divorced" is a dummy variable that takes the value of 1 if the respondents' parents are divorced. In addition, the regressions include control variables for an individuals' self-stated difficulty of raising 100 CHF as an income measure, gender, whether the respondent was born in Switzerland, age, previous level of schooling, the occupation, and both parents' level of education.

Again, Model I and Models III -VI use the IQ score as a measure of cognitive ability, while Model II uses school grades in German, English and Mathematics. Models III, IV and V use three subscales of the Grit scale (Consistency of Interest, Perseverance of Effort, and Ambition, respectively) instead of the full scale. Finally, Model VI does not use two dummy variables for being risk averse or risk loving, but γ, the coefficient of relative risk aversion assuming CRRA utility.

We now turn to the discussion of the results. Hypothesis 1 stated that, ceteris paribus, individuals with higher cognitive ability should have better decision-making abilities and hence be less likely to binge. However, as in the previous regressions, we do not find any significant relationship between our various measures of cognitive ability and the decision to binge.

The next hypothesis, H2, stated that ceteris paribus, more conscientious individuals should have better decision-making skills. Here, we find indeed that more conscientious individuals are indeed significantly less likely to binge.

H3 stated that, ceteris paribus, individuals with higher grit scores should have better decision-making skills. Only two subscales of the Grit score (the Perseverance of Effort and the Ambition scale) are significantly negatively correlated with the probability of bingeing.

H4 stated that individuals with higher levels of cognitive reflection should have better decision-making abilities and hence be less likely to binge. Here, we find, surprisingly, that individuals with higher CRT scores are significantly more likely to engange in binge drinking.

Our last two hypotheses stated the possible impact of economic preferences on educational investment decisions. H5 posited that ceteris paribus, more patient individuals should be less likely to engage in beinge drinking, but we do not find a significant effect of this variable.

H6 stated that, ceteris paribus, individuals with higher degrees of risk aversion should make better decisions. We used the same measures of risk attitude as in the regressions for sureness to graduate, but for the decision to binge, we find that risk-loving individuals are significantly more likely to binge.

The previous section has shown that there seem to be remarkable differences in the determinants of the three decisions that we have analyzed. Those differences in the determinants of the sureness to graduate and the probability of smoking or bingeing, respectively, might be due to at least two different reasons. One the one hand, the social settings of the two decision-making processes are completely different, and on the other hand, the time span involved in the decision-making process is different. The decision to start an apprenticeship training is typically the result of long-term decision-making process that is guided by parents, teachers and occupational guidance counselors. The decision to smoke or to binge, on the other hand, is typically the result of a short-term, spontaneous decision-making process that takes place among peers, possibly involving social pressure. In fact, Gardner and Steinberg (2005) find that adolescents are significantly more likely to take risks when they are in groups with peers than when they are alone. Finally, the addictive potential of smoking might bias the impact of decision-making skills.

4.5 Conclusion

This essay presented results on individuals' sureness to graduate from a field experiment, using apprenticeship "freshmen" as subjects. The sureness to graduate is seen as the result of an individual's decision-making abilities, which, in turn, should be influenced by personality traits and cognitive ability as well as economic preference parameters. In addition to economic choice questions to elicit those parameters, subjects also took a Big Five 15-item short scale (Gerlitz and Schupp 2005), the Grit score (Duckworth et al. 2007) and the Cognitive Resonance Test (Frederick 2005) and answered a background questionnaire. We presented results for the determinants of de-

termination to graduate from apprenticeship training and, as an additional robustness check, for the relationship between economic and psychological "unobservables" and risky behavior, assuming that engaging in those risky behaviors is the result of poor decision-making abilities.

Results seem to suggest that psychological characteristics matter more for most analyzed outcomes here than economic preference parameters. We find that "grittier" and more emotionally stable individuals are significantly more sure about their graduation. Neither risk attitude nor time preference or cognitive ability are correlated with sureness to graduate. Risk-averse individuals are significantly less likely to smoke, and grittier and more conscientious individuals are significantly less likely to binge. We conjecture that the remarkable differences in determinants of the three different outcomes might be driven by the different situations in which the decisions are usually made. The full potential of the data set for analyses of educational decisions is going to be realized in the years to come when follow-up questionnaires and the resulting longitudinal dimension are going to enable further analyses, for example of an individual's actual graduation or labor market success.

Chapter 5

Conclusion

The aim of this thesis was an analysis of the determinants of adolescents' educational investment decisions and decision-making skills for educational and health-related investment decisions. While the first essay aimed at assessing the determinants of a risky investment decision, the decision to drop out of apprenticeship training, the second essay provided an analysis of the impact of another widespread risky behavior, marijuana consumption, during youth on individuals' educational success and labor market outcomes. Finally, the third essay presented results on the impact of personality traits, cognitive ability and economic preference parameters on human capital investment-related decision-making ability, namely, individual sureness to graduate, smoking, and binge drinking.

The main contributions of the first essay are, firstly, the importance of financial considerations for dropouts and, secondly, the result that the determinants of different choices after the dissolution of an apprenticeship contract vary greatly. In particular, less favorable local labor market conditions lead to lower hazards of staying within the educational system. These results provide evidence for the predictions of human capital theory with respect to the costs and benefits of an educational investment. Higher opportunity costs and financial distress, as well as lower expected benefits from the educational investment as the result of living in a region with high unemployment, lead to significantly lower hazards of staying within the educational system.

The second essay adds to the existing evidence on the impact of marijuana consumption on educational success and labor market outcomes by using an explicit theoretical foundation, by focusing on different ages of onset, by presenting evidence for a representative sample of the population, and by analyzing longer-term outcomes, such as individuals' employment probability. The main contributions of this essay are that there are indeed remarkable differences for different age periods of onset and for the probability of having either at least a secondary or a tertiary education, as well as for the probability of being unemployed. Onset of marijuana consumption before age 14 leads to a lower probability of having at least a secondary education, and onset of marijuana consumption under age 16 leads to a significantly higher probability of being unemployed. The adopted instrumental variables estimation strategy allows to interpret these findings as the causal impact of marijuana consumption on outcomes and provides empirical evidence for the existence of critical periods in adolescence during which marijuana consumption is a disinvestment in human capital, leading to lower probabilities of finishing secondary education and being employed.

Finally, the third essay analyzes the impact of personality traits, ability and economic preferences on three different outcomes of decision-making processes: sureness to graduate from apprenticeship training, being a smoker, and having had a binge drinking episode during the year before the experiment. There is surprisingly little research in both psychology and economics on the relationship between personality traits and economic preference parameters on the one hand and decision-making ability on the other hand. We present several hypotheses in order to explore those relationships and find that grittier individuals are significantly more determined to graduate, that risk averse individuals are significantly less likely to smoke, and that more conscientious individuals are significantly less likely to drink. These findings suggest that different traits and abilities matter in different decision-making settings.

There are, of course, also limits to this study. The analysis of dropout behavior in the first essay of this thesis would benefit greatly from the introduction of other possible determinants of the decision to drop out of apprenticeship

training. Information on family background, school performance, characteristics of the training firm and social networks of respondents could provide valuable insights on other possible determinants of the dropout decision. The finding that a higher percentage of friends in school or apprenticeship training or in an employment relationship as a skilled worker (as compared to friends who are unemployed or working as unskilled workers) is associated with a significantly higher probability to be sure about graduation from the last essay hints at the importance of peer groups for adolescents' educational decisions. Also, a true control group of individuals who graduated from apprenticeship training (instead of using those whose apprenticeship contract was terminated because of the bankruptcy of their training firm) would of course be preferable. In addition, it is possible that individuals who are labeled as dropouts in my analysis go back to apprenticeship training or school later on (they were asked about their status exactly in the year in which they terminated their apprenticeship contract). A longitudinal data set would enable researchers to analyze this possibility, as well as the possible effects of having dropped out and interrupted one's training later in young workers' professional lives. However, the lack of more appropriate data for the analysis of apprenticeship dropouts leaves these points as desiderata for future research.

The second essay on the effects of marijuana consumption on educational success and employment probability uses information provided by respondents on past behaviors and thus introduces a quasi-longitudinal element into the analysis of a cross-sectional data set. While the instruments that I have used seem intuitively sensible, the lack of an appropriate test for instrument validity in the multivariate probit model prevents me from carrying out a formal test of their appropriateness. Also, the lack of a formal test of the model assumptions in the multivariate probit model is of course a downside. In addition, the impossibility to take other risky behaviors into account in the analysis is of course unsatisfactory. Propensity score matching methods would provide an opportunity to overcome this drawback, but the matching quality that could be realized using the Swiss Health Survey did not prove to be sufficient by commonly accepted quality standards, while it might be

possible to achieve a satisfactory matching quality using richer data sets.
The third essay presents results on the determinants of decision-making ability in the field of educational and health investment decisions. While time preference should be a key determinant of human capital investment, its empirical relevance for educational investments has hardly ever been analyzed before. By linking the advantages of experimentally elicited information on typically unobservable characteristics (risk and time preference) to a longitudinal study tracing adolescents' educational career and early job market success, we will be able to analyze the causal impact of these traits on educational outcomes and labor market success in the years to come. The design of the study will allow us to draw conclusions on the causal impact of preferences on educational outcomes and to add evidence to the growing field of research on the relationship between lab behavior and field outcomes. Follow-up studies after 3 or 4 years, respectively, will show whether experimentally elicited preferences, ability and personality traits can predict real-world educational outcomes.
These results provide empirical evidence for several predictions of human capital theory and its extensions with respect to educational investment decisions. Higher monetary and opportunity costs significantly decrease the probability of finishing the educational investment decision of apprenticeship training and of staying within the educational system, local labor markets with high unemployment rates that decrease expected benefits of this educational investment significantly increase the probability of leaving the educational system, resulting in lower human capital investment. There seem to exist critical periods in adolescence during which the onset of marijuana consumption as a disinvestment in human capabilities causally translates into lower probabilities of finishing an educational investment such as secondary education. In addition, there seem to be critical periods of marijuana consumption as a disinvestment in human capabilities that lead to lower employment probabilities. These results show that it is important to take the timing of investments into account. The lack of research on a third major implication of human capital theory - educational investments should be lower, ceteris paribus, for individuals who discount the future more heavily - led to

the design of a field experiment that is going to provide evidence in order to test this prediction.

I think that there are at least two interesting avenues for future research in the field. The first one would be the development of indicators and measures of "impatience" and "readiness to assume risk" other than time preference and risk attitude that are also able to predict educational investment and disinvestment decisions. Interdisciplinary cooperations with researchers in personality psychology and cognitive neuroscience might be the most fruitful strategy for economists to learn more about these questions. Those indicators might also be used to identify at-risk individuals and enable policymakers to develop specific counseling and guidance for them in order to avoid risky choices, such as the decision to drop out of apprenticeship training. The second one would be research on individuals' decision-making ability, whether and how it is be shaped by personality traits and ability, and whether and how decision-making differs for different types of choices and different decision situations.

Finally, those new measures and evidence on their evolution over the life cycle might, eventually, contribute to an explanation why "the contempt of risk and the presumptuous hope of success are in no period of life more active than at the age at which young people choose their professions", as the introductory quote by Adam Smith stated.

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Appendix A

Additional Material for Chapter 2

A.1 Complete Summary Statistics

Table A.1: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	n
1 = non-native parents	0.0786	0.2692	0	1	1819
appr.wage/wage for unskilled worker	0.3210	0.0912	0	0.7893	1059
1 = boy in occupation with more than 60% females	0.2243	0.4172	0	1	1819
1 = girl in occupation with more than 60% males	0.2095	0.4070	0	1	1819
1 = no school leaving certificate	0.0324	0.1772	0	1	1819
1 = Realschule graduate	0.4107	0.4921	0	1	1819
1 = Fachabitur holder	0.0522	0.2225	0	1	1819
1 = Gymnasium graduate	0.0858	0.2801	0	1	1819
1 = contract termination in business-related occupation	0.3018	0.4592	0	1	1819
1 = contract termination in crafts occupation	0.2820	0.4501	0	1	1819
1 = contract termination in technical occupation	0.2380	0.4260	0	1	1819
1 = firm size between 10 and 49 employees	0.3458	0.4758	0	1	1819
1 = firm size between 50 and 99 employees	0.1028	0.3038	0	1	1819
1 = firm size between 100 and 499 employees	0.0935	0.2912	0	1	1819
1 = firm size over 500 employees	0.0671	0.2502	0	1	1819
1 = bad prospects as a reason for termination	0.0439	0.2051	0	1	1819
1 = bad income prospects as a reason for termination	0.0616	0.2404	0	1	1819
1 = bad career prospects as a reason for termination	0.0439	0.2051	0	1	1819
1 = exam nerves as a reason for termination	0.0379	0.1911	0	1	1819
1 = financial distress as a reason for termination	0.0539	0.2258	0	1	1819
% of youths in full-time school for dually provided occupation	0.1520	0.1668	0.0208	0.6169	1819
working age population density	0.1857	0.1389	0.0548	0.5555	1819
public transport density	0.2697	0.1898	0.0559	0.7376	1819
local unemployment rate	0.0891	0.0459	0.0468	0.2008	1819

Further data sources:
The data set included information on the regional provenance of respondents

which enabled us to add information on the regions of origin. The Chambers consist of several administrative districts (*Landkreise, kreisfreie Städte*), and data on district level are available from the German Federal Office for Building and Regional Planning's "Indicators and Maps on Spatial and Urban Development" (Indikatoren und Karten zur Raum- und Stadtentwicklung, INKAR). These district-level data were then aggregated on chamber level and merged to the original data set, so that each individual was also assigned regional-level characteristics. We used information on regional unemployment rates, surface, working age population (between age 15 and 65) and availability of public transport. The working age population density is calculated as the ratio of working age population and surface. The availability of public transport is measured as the population that can be reached within one hour by public transport ("Erreichbares Bevölkerungspotential", a commonly used measure in spatial development research.
As a third data source, we used data from the German Federal Employment Agency's statistics (Bundesagentur für Arbeit) on the labour market for apprentices and on the numbers of youth enrolled in full-time schools for usually dually provided occupations. The employment centers gather information on **registered** apprenticeship-seeking youths and on registered open apprenticeship places, and calculate a supply-demand ratio (the number of offered apprenticeship places per 100 apprenticeship seekers). However, as the employment centers can only use **registered** numbers for their calculations, these numbers do not give a complete picture of regional apprenticeship markets. Most places are filled directly without the intermediary of the job centre and are therefore not included in the centres' statistics. However, this is the only available information source on the labor market for apprentices. Additionally, we included a measure aiming at capturing the relative frequency of non-firm-provided training in full-time vocational schools (*überbetriebliche Ausbildung*). This is a labor market measure where youths complete apprenticeship training in full-time schools, and not in both a firm and a school. We included the percentage of youths in this labor market measure among all youths in apprenticeship training in a region.

A.2 Additional Estimation Results

A.2.1 Simple Hazard Rates

Table A.2: Simple Hazard Rates, full results

	Model I	Model II	Model III	Model IV	Model V	Model VI
d1	0.107***	0.111*	0.123**	0.042***	0.043***	0.037***
	[0.071]	[0.141]	[0.106]	[0.015]	[0.023]	[0.018]
d2	0.272**	0.405	0.254	0.073***	0.078***	0.062***
	[0.180]	[0.513]	[0.221]	[0.026]	[0.041]	[0.031]
d3	0.649	1.084	0.596	0.132***	0.148***	0.112***
	[0.448]	[1.441]	[0.536]	[0.049]	[0.080]	[0.056]
d4	1.700	7.457	1.114	0.342***	0.751	0.195***
	[1.270]	[10.835]	[1.066]	[0.136]	[0.426]	[0.107]
d5	2.239		1.852	0.633	1.752	0.412
	[2.085]		[2.020]	[0.339]	[1.781]	[0.282]
apprenticeship wage/wage unskilled	1.273	1.954	1.178	1.388*	1.188	1.476
	[0.322]	[0.918]	[0.362]	[0.268]	[0.425]	[0.349]
1 = non-native parents	0.030***	0.008*	0.030***			
	[0.033]	[0.022]	[0.039]			
1 = female	0.938			0.824		
	[0.234]			[0.146]		
1 = male in occupation with	0.941		0.874	0.900		0.877
more than 60% females	[0.181]		[0.170]	[0.137]		[0.135]
1 = female in occupation with	1.279	1.253		1.193	1.175	
more than 60% males	[0.310]	[0.315]		[0.208]	[0.209]	
1 = school dropout	1.707*	2.488	1.539	1.754**	1.705	1.849**
	[0.537]	[1.560]	[0.563]	[0.406]	[0.658]	[0.538]
1 = Realschule	0.587***	0.515**	0.567**	0.582***	0.579***	0.586***
	[0.104]	[0.152]	[0.136]	[0.079]	[0.115]	[0.111]
1 = Fachabitur	0.203***		0.464	0.171***	0.066***	0.266**
	[0.108]		[0.268]	[0.080]	[0.068]	[0.142]
1 = Abitur	0.196***	0.199**	0.161*	0.283***	0.243***	0.343**
	[0.118]	[0.151]	[0.166]	[0.100]	[0.122]	[0.181]
1 = business	1.186	1.131	1.128	0.888	0.785	0.879
	[0.360]	[0.506]	[0.562]	[0.155]	[0.177]	[0.262]
1 = crafts	0.846	0.967	0.738	0.668**	0.908	0.552**
	[0.276]	[0.526]	[0.355]	[0.124]	[0.244]	[0.148]
1 = technical	0.537*	0.891	0.503	0.524***	0.435*	0.517**
	[0.183]	[0.567]	[0.242]	[0.105]	[0.187]	[0.137]
1 = firm size	1.375*	1.773*	1.248	1.244	1.551**	1.104
betw. 10-49 employees	[0.252]	[0.556]	[0.290]	[0.172]	[0.330]	[0.205]
1 = firm size	1.304	0.744	1.525	1.103	0.655	1.368
betw. 50-99 employees	[0.349]	[0.482]	[0.475]	[0.229]	[0.266]	[0.337]
1 = firm size	0.987	1.878	0.750	1.105	1.552	0.919
betw. 100-499 employees	[0.289]	[0.888]	[0.296]	[0.233]	[0.508]	[0.256]
1 = firm size	1.718*	2.307	1.471	1.491*	1.748	1.333
over 500 employees	[0.548]	[1.202]	[0.646]	[0.344]	[0.688]	[0.392]
1 = bad prospects	1.127	0.911	1.329	0.826	1.782	0.616
reason for termination	[0.504]	[0.922]	[0.714]	[0.301]	[1.001]	[0.299]
1 = bad income prospects	1.945**	2.913**	1.428	1.678**	2.578**	1.413
reason for termination	[0.581]	[1.483]	[0.585]	[0.398]	[0.972]	[0.453]
1 = bad career prospects	0.800	0.993	0.732	0.837	0.281*	1.205
reason for termination	[0.400]	[1.029]	[0.452]	[0.321]	[0.208]	[0.534]
1 = exam nerves	1.151	1.420	1.150	1.159	0.882	1.223
reason for termination	[0.326]	[0.864]	[0.381]	[0.239]	[0.311]	[0.324]
1 = financial distress	2.332***	2.651**	2.259***	1.847***	1.864*	1.766**
reason for termination	[0.527]	[1.279]	[0.600]	[0.331]	[0.600]	[0.396]
local percentage of youth	1.143	7.223	0.279	0.611	2.335	0.169
in out-of-firm training	[1.517]	[16.026]	[0.488]	[0.635]	[3.707]	[0.249]
local population density	9.612	0.218	14.584	0.674	2.460	0.235
	[25.561]	[1.149]	[48.456]	[1.312]	[8.628]	[0.583]
local supply-demand ratio	0.761	0.275	1.388	0.876	0.929	0.944
on the job market for apprentices	[0.417]	[0.280]	[0.915]	[0.314]	[0.594]	[0.423]
local density of public transport	0.365	4.449	0.267	4.081	1.562	9.230
	[0.734]	[17.695]	[0.668]	[6.015]	[4.076]	[17.524]
local unemployment rate	0.219	0.001	51.386	20.515	0.015	5,348.168
	[1.213]	[0.008]	[371.367]	[85.881]	[0.109]	[30,370.540]
Observations	2329	818	1439	3879	1785	2094
LogL	-566,189	-182,985	-366,613	-978,400	-395,143	-567,219

Table A.3: Simple Hazards, logit specification

	Model I	Model II	Model III	Model IV	Model V	Model VI
d1	0.118***	0.152	0.121**	0.042***	0.042***	0.036***
	[0.085]	[0.205]	[0.114]	[0.016]	[0.024]	[0.019]
d2	0.309	0.595	0.258	0.074***	0.078***	0.062***
	[0.222]	[0.799]	[0.245]	[0.029]	[0.045]	[0.033]
d3	0.790	1.684	0.652	0.140***	0.152***	0.117***
	[0.593]	[2.388]	[0.642]	[0.055]	[0.089]	[0.063]
d4	2.395	19.756*	1.304	0.424**	1.071	0.219**
	[1.953]	[31.859]	[1.367]	[0.183]	[0.678]	[0.130]
d5	3.566		2.702	0.877	2.831	0.547
	[3.891]		[3.405]	[0.576]	[4.011]	[0.440]
1 = non-native parents	1.282	1.835	1.189	1.410	1.205	1.520
	[0.356]	[0.946]	[0.399]	[0.297]	[0.460]	[0.394]
apprenticeship wage/wage unskilled	0.023***	0.005*	0.025***			
	[0.027]	[0.013]	[0.035]			
1 = female	0.897			0.800		
	[0.243]			[0.152]		
1 = male in occupation with	0.925		0.866	0.905		0.876
more than 60% females	[0.194]		[0.181]	[0.150]		[0.145]
1 = female in occupation with	1.304	1.318		1.210	1.196	
more than 60% males	[0.344]	[0.377]		[0.228]	[0.235]	
1 = school dropout	1.835*	2.532	1.623	1.981***	2.033	1.984**
	[0.661]	[1.841]	[0.674]	[0.522]	[0.910]	[0.650]
1 = Realschule	0.553***	0.462**	0.530**	0.558***	0.547***	0.560***
	[0.106]	[0.154]	[0.136]	[0.081]	[0.119]	[0.113]
1 = Fachabitur	0.176***		0.428	0.151***	0.055***	0.237**
	[0.101]		[0.269]	[0.074]	[0.058]	[0.135]
1 = Abitur	0.178***	0.164**	0.144*	0.269***	0.228***	0.323**
	[0.110]	[0.133]	[0.151]	[0.099]	[0.119]	[0.177]
1 = business	1.236	1.167	1.266	0.876	0.781	0.887
	[0.409]	[0.567]	[0.692]	[0.166]	[0.194]	[0.289]
1 = crafts	0.850	1.024	0.771	0.660**	0.912	0.537**
	[0.303]	[0.614]	[0.407]	[0.133]	[0.268]	[0.157]
1 = technical	0.535*	0.885	0.523	0.508***	0.397**	0.501**
	[0.197]	[0.626]	[0.274]	[0.110]	[0.184]	[0.145]
1 = firm size	1.407*	1.988*	1.257	1.267	1.604**	1.104
betw. 10-49 employees	[0.283]	[0.713]	[0.317]	[0.189]	[0.372]	[0.221]
1 = firm size	1.340	0.766	1.568	1.119	0.662	1.378
betw. 50-99 employees	[0.391]	[0.530]	[0.529]	[0.250]	[0.293]	[0.365]
1 = firm size	0.971	2.028	0.711	1.120	1.639	0.892
betw. 100-499 employees	[0.311]	[1.089]	[0.302]	[0.257]	[0.602]	[0.268]
1 = firm size	1.695	2.239	1.424	1.505	1.638	1.353
over 500 employees	[0.591]	[1.341]	[0.672]	[0.382]	[0.715]	[0.436]
1 = bad prospects	1.137	0.956	1.343	0.806	1.862	0.590
reason for termination	[0.555]	[1.017]	[0.797]	[0.315]	[1.121]	[0.308]
1 = bad income prospects	2.024**	3.335**	1.470	1.751**	2.855**	1.430
reason for termination	[0.686]	[1.945]	[0.676]	[0.462]	[1.196]	[0.504]
1 = bad career prospects	0.734	0.824	0.668	0.809	0.240*	1.233
reason for termination	[0.398]	[0.916]	[0.447]	[0.331]	[0.190]	[0.593]
1 = exam nerves	1.173	1.498	1.156	1.162	0.884	1.224
reason for termination	[0.381]	[1.075]	[0.432]	[0.272]	[0.363]	[0.363]
1 = financial distress	2.714***	2.920*	2.563***	2.010***	2.048**	1.906**
reason for termination	[0.715]	[1.637]	[0.781]	[0.412]	[0.748]	[0.485]
local percentage of youth	1.185	13.615	0.262	0.559	2.233	0.142
in out-of-firm training	[1.696]	[33.834]	[0.490]	[0.618]	[3.883]	[0.221]
local population density	11.918	0.236	20.966	0.715	1.706	0.246
	[34.340]	[1.379]	[74.342]	[1.512]	[6.389]	[0.655]
local supply-demand ratio	0.742	0.267	1.397	0.897	0.998	0.934
on the job market for apprentices	[0.432]	[0.297]	[0.993]	[0.348]	[0.694]	[0.452]
local density of public transport	0.341	4.306	0.235	4.446	2.410	10.098
	[0.739]	[18.905]	[0.625]	[7.086]	[6.715]	[20.432]
local unemployment rate	0.177	0.000	62.712	25.831	0.016	11,020.326
	[1.061]	[0.000]	[484.050]	[116.058]	[0.121]	[66,282.994]
Observations	2329	818	1439	3879	1785	2094
LogL	-566,13354	-183,29233	-366,31373	-978,13933	-395,24779	-567,2051

A.2.2 Competing Risks Models

Table A.4: Competing Risks Model, complementary log-log specification

	dropout I	dropout II	change I	change II	upgrade I	upgrade II
d1	-2.007***	-3.232***	1.555***	-0.708***	-1.672*	-4.222***
	[0.627]	[0.363]	[0.321]	[0.186]	[0.985]	[0.601]
d2	-1.144*	-2.749***	2.158***	-0.239	-1.229	-3.921***
	[0.636]	[0.362]	[0.334]	[0.188]	[1.019]	[0.604]
d3	-0.247	-2.161***	2.772***	0.246	-1.216	-4.098***
	[0.659]	[0.365]	[0.350]	[0.192]	[1.073]	[0.634]
d4	0.734	-1.236***	3.310***	0.358	-1.963	-4.286***
	[0.712]	[0.394]	[0.390]	[0.225]	[1.476]	[0.846]
d5	0.865	-0.679	2.586***	-0.201		
	[0.899]	[0.531]	[0.794]	[0.536]		
apprenticeship wage/wage unskilled	-4.420***		-5.535***		-6.033***	
	[1.001]		[0.518]		[1.375]	
1 = non-native parents	0.257	0.328*	-0.173	-0.124	-0.523	-0.123
	[0.246]	[0.190]	[0.159]	[0.117]	[0.530]	[0.355]
1 = female	-0.031	-0.140	0.174	0.319***	-0.561	-0.627**
	[0.242]	[0.174]	[0.123]	[0.089]	[0.344]	[0.262]
1 = male in occupation with	-0.063	-0.090	0.023	0.019	-0.654*	-0.669**
more than 60% females	[0.189]	[0.151]	[0.111]	[0.087]	[0.377]	[0.282]
1 = female in occupation with	0.205	0.109	-0.342***	-0.189**	0.311	0.206
more than 60% males	[0.238]	[0.172]	[0.128]	[0.085]	[0.353]	[0.266]
1 = school dropout	0.516	0.531**	0.147	0.024	0.267	0.472
	[0.314]	[0.230]	[0.242]	[0.182]	[1.048]	[0.750]
1 = Realschule	-0.532***	-0.521***	0.060	0.192***	0.926***	0.888***
	[0.174]	[0.134]	[0.095]	[0.069]	[0.358]	[0.289]
1 = Fachabitur	-1.616***	-1.634***	-0.022	-0.136	1.100*	1.352***
	[0.535]	[0.428]	[0.206]	[0.155]	[0.561]	[0.406]
1 = Abitur	-1.667***	-1.263***	0.012	0.100	2.276***	2.470***
	[0.601]	[0.354]	[0.185]	[0.125]	[0.416]	[0.313]
1 = business	0.255	-0.071	-0.054	-0.159*	0.378	0.252
	[0.302]	[0.173]	[0.165]	[0.093]	[0.649]	[0.312]
1 = crafts	-0.157	-0.401**	-0.594***	-0.123	-0.431	-0.262
	[0.323]	[0.184]	[0.179]	[0.101]	[0.716]	[0.399]
1 = technical	-0.597*	-0.618***	-0.786***	-0.169	-0.265	0.023
	[0.338]	[0.200]	[0.183]	[0.105]	[0.679]	[0.348]
1 = firm size	0.297	0.224	-0.139	-0.075	0.123	0.113
betw. 10-49 employees	[0.181]	[0.137]	[0.102]	[0.071]	[0.329]	[0.253]
1 = firm size	0.326	0.141	-0.043	-0.164	0.875**	0.901***
betw. 50-99 employees	[0.262]	[0.204]	[0.151]	[0.110]	[0.395]	[0.296]
1 = firm size	0.093	0.171	-0.132	-0.196*	-0.021	0.533*
betw. 100-499 employees	[0.281]	[0.205]	[0.151]	[0.118]	[0.425]	[0.314]
1 = firm size	0.545*	0.427*	-0.029	-0.169	0.219	0.450
over 500 employees	[0.316]	[0.230]	[0.172]	[0.136]	[0.439]	[0.334]
1 = bad prospects	0.257	-0.085	0.327	0.200	-0.932	-0.062
reason for termination	[0.418]	[0.353]	[0.240]	[0.168]	[0.816]	[0.542]
1 = bad income prospects	0.665**	0.558**	0.101	0.329**	-0.158	0.013
reason for termination	[0.291]	[0.234]	[0.195]	[0.135]	[0.565]	[0.430]
1 = bad career prospects	-0.400	-0.305	0.123	0.168	0.789	0.587
reason for termination	[0.492]	[0.387]	[0.245]	[0.174]	[0.500]	[0.411]
1 = exam nerves	0.182	0.197	-0.342	-0.686***	-0.814	-1.291
reason for termination	[0.277]	[0.203]	[0.248]	[0.182]	[1.025]	[1.013]
1 = financial distress	0.891***	0.628***	-0.688***	-0.401***	-0.130	-0.455
reason for termination	[0.222]	[0.177]	[0.234]	[0.152]	[0.737]	[0.594]
local percentage of youth	0.037	-0.833	3.354***	2.822***	1.777	0.237
in out-of-firm training	[1.293]	[1.024]	[0.632]	[0.486]	[2.001]	[1.747]
local population density	2.367	-0.581	0.589	-0.105	5.912	1.368
	[2.612]	[1.926]	[1.392]	[1.012]	[4.550]	[3.610]
local supply-demand ratio	-0.380	-0.211	0.484*	0.431**	-0.001	0.077
on the job market for apprentices	[0.543]	[0.356]	[0.251]	[0.186]	[0.882]	[0.689]
local density of public transport	-1.134	1.449	-1.197	-0.281	-3.928	-0.398
	[1.968]	[1.459]	[1.028]	[0.747]	[3.386]	[2.688]
local unemployment rate	-0.585	4.433	-15.292***	-12.684***	-12.224	-5.246
	[5.414]	[4.147]	[2.800]	[2.125]	[8.730]	[7.331]
Observations	2394	3991	2394	3991	2385	3975
LogL	-582.103	-1007.355	-1233.005	-2247.702	-272.258	-459.578

Appendix B

Additional Material for Chapter 3

B.1 Complete Summary Statistics

Table B.1: Summary Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
1 = at least secondary education	0.8759	0.3298	0	1
1 = tertiary education	0.1935	0.3951	0	1
1 = unemployed	0.0177	0.1319	0	1
1 = working less than 80%	0.3543	0.4783	0	1
1 = marijuana onset under 14	0.0036	0.0601	0	1
1 = marijuana onset between 15 and 16	0.0819	0.2742	0	1
1 = marijuana onset between 17 and 18	0.0965	0.2954	0	1
Age	31.7932	6.3514	15	40
1 = female	0.5323	0.4990	0	1
Level of religiousness (1-7)	2.0931	1.2499	1	7
Body Mass Index	23.2122	3.6213	10.4489	44.9219
Level of mastery	2.1316	0.7471	1	3
Level of optimism	3.5464	0.6045	1	4
1 = uses sunscren	0.8950	0.3066	0	1
1 = health is important	2.0143	0.5364	1	3
1 = nutrition is important	0.6842	0.4649	0	1
1 = Swiss citizen	0.8759	0.3298	0	1
1 = Father swiss	0.7668	0.4229	0	1
1 = Mother swiss	0.7777	0.4158	0	1
1 = Region Central	0.1724	0.3778	0	1
1 = Region Leman	0.1563	0.3632	0	1
1 = Region Mittelland	0.2655	0.4417	0	1
1 = Region Northwest	0.1328	0.3394	0	1
1 = Region Zurich	0.0762	0.2654	0	1
1 = Region East	0.1321666	0.3387	0	1
1 = Region Ticino	0.0646	0.2458	0	1
1 = mun. under 1000	0.1085	0.3109	0	1
1 = mun. between 1000-1999	0.1131	0.3167	0	1
1 = mun. between 2000-4999	0.2317	0.4220	0	1
1 = mun. between 4000-9999	0.1772	0.3819	0	1
1 = mun. between 10000-19999	0.1533	0.3603	0	1
1 = mun. between 20000-49999	0.0901	0.2864	0	1
1 = mun. between 50000-99999	0.0257	0.1584	0	1
1 = mun. over 100000	0.1004	0.3006	0	1

B.2 Data Sources

Data on the cantonal-level availability of marijuana, measured as the number of drug trafficking delicts per capita at the time when the individual started to use marijuana, were taken from the Swiss Federal Statistical Office's Police Drug Statistics ("Polizeiliche Betäubungsmittelstatistik) since 1974.
All other data are from the Swiss Health Survey (Schweizerische Gesundheitsbefragung), wave 2002.

B.3 Additional Estimation Results

B.3.1 Educational Outcomes

Table B.2: Educational Outcomes: Full Regression Results

	secondary mvprobit	secondary probit	tertiary mvprobit	tertiary probit
Marijuana under 14	-0.367*	-0.391***	0.187	0.067
	[0.216]	[0.112]	[0.248]	[0.137]
Marijuana 15-16	-0.146	0.039	-0.197	-0.127*
	[0.226]	[0.087]	[0.192]	[0.072]
Marijuana 17-18	0.104	0.194***	-0.221**	-0.068
	[0.278]	[0.047]	[0.109]	[0.070]
Marijuana over 18			0.098	0.193**
			[0.161]	[0.089]
Age	0.079***	0.080***	0.050***	0.049***
	[0.006]	[0.006]	[0.004]	[0.003]
Female	-0.114	-0.103*	-0.673***	-0.658***
	[0.073]	[0.060]	[0.057]	[0.052]
Body Mass Index	0.000	0.001	-0.025***	-0.025***
	[0.004]	[0.004]	[0.008]	[0.007]
Mastery	0.031	0.036	0.011	0.016
	[0.038]	[0.039]	[0.024]	[0.021]
Optimism	0.084	0.086	0.141***	0.140***
	[0.055]	[0.055]	[0.021]	[0.021]
Uses sunscreen	0.407***	0.408***	0.205**	0.203**
	[0.051]	[0.048]	[0.090]	[0.090]
Health important	-0.079*	-0.073	0.015	0.020
	[0.044]	[0.047]	[0.027]	[0.027]
Nutrition important	0.237***	0.233***	0.102	0.098
	[0.021]	[0.021]	[0.071]	[0.072]
Swiss	0.507***	0.493***	0.171	0.160
	[0.185]	[0.189]	[0.119]	[0.115]
Swiss father	0.099	0.100	-0.066	-0.066
	[0.100]	[0.098]	[0.050]	[0.050]
Swiss mother	0.081	0.081	-0.118	-0.124
	[0.151]	[0.145]	[0.108]	[0.109]
Region Leman	-0.068***	-0.081**	0.225***	0.211***
	[0.024]	[0.036]	[0.028]	[0.028]
Region Mittelland	-0.060	-0.072***	0.075***	0.064***
	[0.038]	[0.023]	[0.020]	[0.015]
Region Northwest	0.063**	0.054	-0.028	-0.039*
	[0.032]	[0.040]	[0.023]	[0.022]
Zurich	-0.108***	-0.115**	0.018	0.005
	[0.035]	[0.047]	[0.028]	[0.027]
Region East	-0.076***	-0.078***	-0.163***	-0.169***
	[0.010]	[0.007]	[0.010]	[0.008]
Region Ticino	0.078**	0.081**	-0.198***	-0.199***
	[0.032]	[0.032]	[0.016]	[0.016]
municipality betw. 1000 and 1999	0.036	0.033	0.053	0.045
	[0.070]	[0.067]	[0.037]	[0.037]
municipality betw. 2000 and 4999	-0.010	-0.012	0.105**	0.098**
	[0.100]	[0.095]	[0.049]	[0.049]
municipality betw. 5000 and 9999	0.085	0.082	0.198***	0.189***
	[0.109]	[0.108]	[0.047]	[0.046]
municipality betw. 10000 and 19999	0.136	0.132	0.298***	0.293***
	[0.134]	[0.134]	[0.060]	[0.057]
municipality betw. 20000 and 49999	0.079	0.067	0.475***	0.461***
	[0.134]	[0.122]	[0.085]	[0.083]
municipality betw. 50000 and 99999	0.229*	0.212*	0.561***	0.545***
	[0.132]	[0.127]	[0.122]	[0.118]
municipality over 100000	0.270	0.247	0.610***	0.588***
	[0.212]	[0.186]	[0.061]	[0.050]
Constant	-2.481***	-2.554***	-2.649***	-2.668***
	[0.088]	[0.107]	[0.192]	[0.176]
Observations	4555	4555	4998	4998
LogPseudoL	-4393.8903	-1433.2109	-6627.2148	-2185.9083
Pseudo R^2		0.1942		0.1086

B.3.2 Labor Market Success

Table B.3: Labor Market Outcomes: Full Regression Results

	unemployed mvprobit	unemployede probit
compulsory schooling	-0.011	-0.010
	[0.123]	[0.121]
secondary education	-0.246	-0.248
	[0.176]	[0.174]
tertiary education	-0.030	-0.030
	[0.135]	[0.135]
Marijuana under 14	0.718**	0.520**
	[0.315]	[0.220]
Marijuana 15-16	0.292*	0.328**
	[0.160]	[0.163]
Marijuana 17-18	0.125	0.206**
	[0.087]	[0.089]
Marijuana over 18	0.274	0.251
	[0.200]	[0.154]
Age	0.017***	0.016***
	[0.004]	[0.004]
Female	0.212**	0.216***
	[0.087]	[0.083]
Married	-0.231***	-0.231***
	[0.044]	[0.044]
Binge drinking	0.015	0.015
	[0.029]	[0.029]
Body Mass Index	-0.019	-0.019
	[0.013]	[0.013]
Mastery	0.085	0.086
	[0.062]	[0.062]
Optimism	-0.425***	-0.427***
	[0.083]	[0.081]
Swiss	-0.043	-0.048
	[0.155]	[0.159]
Swiss father	-0.126	-0.126
	[0.195]	[0.193]
Swiss mother	-0.107	-0.109
	[0.117]	[0.113]
Region Leman	-0.178***	-0.181***
	[0.067]	[0.065]
Region Mittelland	-0.043	-0.048
	[0.048]	[0.046]
Region Northwest	-0.240***	-0.239***
	[0.073]	[0.071]
Zurich	-0.113*	-0.117*
	[0.064]	[0.062]
Region East	-0.125***	-0.125***
	[0.034]	[0.032]
Region Ticino	0.389***	0.387***
	[0.053]	[0.053]
municipality betw. 1000 and 1999	-0.019	-0.026
	[0.206]	[0.205]
municipality betw. 2000 and 4999	0.013	0.009
	[0.188]	[0.187]
municipality betw. 5000 and 9999	0.088	0.081
	[0.210]	[0.207]
municipality betw. 10000 and 19999	0.150	0.149
	[0.247]	[0.247]
municipality betw. 20000 and 49999	0.053	0.045
	[0.254]	[0.253]
municipality betw. 50000 and 99999	0.232	0.222
	[0.249]	[0.244]
municipality over 100000	0.339*	0.329*
	[0.186]	[0.185]
Constant	-0.697	-0.667
	[0.620]	[0.602]
Observations	4998	4998
Log PseudoL	-4857.9337	-400.90385
Pseudo R^2		0.1105

Appendix C

Additional Material for Chapter 4

C.1 Complete Summary Statistics

Table C.1: Complete summary statistics

Variable	n	Mean	Std. Dev.	Min	Max
Grade in German	218	4.7573	0.4356	3.5	6
Grade in Math	218	4.8234	0.6344	2.5	6
Grade in English	218	4.8759	0.6330	2.5	6
Number of applications	218	24.0367	31.2677	0	250
How sure to finish? (scale from 1 - 5)	218	4.3303	0.7127	0	5
Mother employed	218	0.7339	0.4429	0	1
Father employed	218	0.9266	0.2614	0	1
Parents divorced	218	0.2156	0.4122	0	1
Number of siblings	218	1.4817	0.9068	0	5
1 = born in Switzerland	218	0.8991	0.3019	0	1
1 = female	218	0.3807	0.4867	1	2
Certainty equivalent	218	5.0321	1.6133	0	9
Switch point in discounting	218	71.4908	19.3251	20	100
Grit score	218	3.4072	0.4537	2.2941	4.5882
Consistency of Interest Score	218	3.2278	0.6885	1	5
Perseverance of Effort Score	218	3.5076	0.5609	1.8333	4.8333
1 = rather or very sure to finish	218	0.9174	0.2759	0	1
Age	218	16.3440	0.8830	15	21
1 = Business assistant	218	0.6055	0.4899	0	1
1 = Electrician	218	0.2156	0.4122	0	1
1 = Polytechnician	218	0.1789	0.3841	0	1
Big 5: Openness	218	49.9210	8.7687	16.3171	73.5662
Big 5: Conscientiousness	218	49.9366	8.2783	26.9324	73.9971
Big 5: Extraversion	218	49.9384	8.2674	27.6028	81.2982
Big 5: Agreeableness	218	50.0116	7.3904	30.6405	69.3361
Big 5: Emotional stability	218	49.7495	6.9105	28.8224	68.9261
% of friends in training or working skilled	218	0.9274	0.1439	0	1
1 = risk averse	218	0.3945	0.4899	0	1
1 = risk loving	218	0.3670	0.4831	0	1
1 = time inconsistent choice	218	0.6239	0.4855	0	1

C.2 Additional Results

C.2.1 Full Regression Results

Table C.2: Full regression results: Determinants of Sureness

	Model I	Model II	Model III	Model IV	Model V	Model VI
CRT score	0.143	0.057	0.180	0.155	0.189	0.221
	[0.251]	[0.261]	[0.260]	[0.245]	[0.257]	[0.306]
IQ score	-0.005		-0.004	-0.004	-0.006	-0.008
	[0.011]		[0.011]	[0.010]	[0.011]	[0.011]
Grade German		0.290				
		[0.691]				
Grade English		0.037				
		[0.359]				
Grade Math		0.523				
		[0.429]				
Grit score	0.952*	0.963*	0.745**	-0.114	0.781**	0.596
	[0.487]	[0.503]	[0.332]	[0.382]	[0.387]	[0.483]
1 = risk averse	-0.435	-0.393	-0.576	-0.430	-0.437	
	[0.487]	[0.476]	[0.513]	[0.462]	[0.482]	
1 = risk loving	0.900	1.163*	0.855	0.942	1.035*	
	[0.585]	[0.675]	[0.601]	[0.593]	[0.602]	
γ						-0.054
(coeff. of risk aversion)						[0.152]
Switchpoint in discounting	0.005	0.004	0.004	0.006	0.006	0.000
	[0.010]	[0.010]	[0.011]	[0.010]	[0.010]	[0.010]
Big Five:	-0.006	-0.009	0.008	0.007	-0.009	-0.015
Openness	[0.021]	[0.022]	[0.021]	[0.022]	[0.021]	[0.022]
Big Five:	-0.036	-0.034	-0.027	-0.030	-0.042	-0.050
Conscientiousness	[0.035]	[0.037]	[0.036]	[0.035]	[0.037]	[0.038]
Big Five:	-0.015	-0.005	-0.012	-0.026	-0.017	-0.028
Extraversion	[0.028]	[0.029]	[0.028]	[0.028]	[0.029]	[0.032]
Big Five:	0.028	0.042	0.018	0.020	0.033	0.024
Agreeableness	[0.029]	[0.032]	[0.030]	[0.028]	[0.030]	[0.029]
Big Five:	0.089**	0.096**	0.102***	0.078**	0.090**	0.090***
Emotional Stability	[0.035]	[0.037]	[0.038]	[0.033]	[0.036]	[0.034]
number of applications for apprenticeship place	-0.011*	-0.013*	-0.011	-0.009	-0.012*	-0.006
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.006]
friendsGOOD	2.418**	2.143*	2.762**	2.991***	2.822**	3.403***
	[1.128]	[1.198]	[1.160]	[1.150]	[1.097]	[1.307]
parents divorced	0.112	0.458	0.238	0.041	-0.001	0.345
	[0.534]	[0.605]	[0.547]	[0.499]	[0.539]	[0.565]
number of siblings	-0.753***	-0.835***	-0.806***	-0.732***	-0.763***	-0.631***
	[0.225]	[0.245]	[0.237]	[0.221]	[0.230]	[0.219]
difficulty of raising 100 CHF	0.032	0.048	0.002	0.080	0.132	-0.014
	[0.197]	[0.210]	[0.215]	[0.200]	[0.200]	[0.210]
1 = born in CH	0.524	0.596	0.371	0.404	0.682	0.440
	[0.545]	[0.562]	[0.559]	[0.503]	[0.549]	[0.562]
1 = female	-0.587	-0.570	-0.824	-0.643	-0.484	-0.793
	[0.719]	[0.744]	[0.774]	[0.701]	[0.719]	[0.723]
age	-0.203	-0.249	-0.219	-0.206	-0.226	-0.148
	[0.207]	[0.214]	[0.205]	[0.205]	[0.205]	[0.210]
electrician	-0.691	-0.569	-0.677	-0.619	-0.691	-0.812
	[0.747]	[0.777]	[0.779]	[0.722]	[0.756]	[0.758]
polytechnician	0.631	0.606	0.619	0.701	0.537	
	[1.009]	[0.999]	[1.049]	[0.959]	[1.011]	
1 = sekb	-0.733	-0.995*	-0.726	-0.707	-0.639	-0.288
	[0.471]	[0.554]	[0.488]	[0.460]	[0.470]	[0.482]
1 = tenthyear	0.670	0.635	0.924	0.811	0.673	0.662
	[0.673]	[0.737]	[0.714]	[0.657]	[0.684]	[0.628]
1 = other schooling						
mother's education	-0.026	-0.114	-0.029	-0.044	-0.043	-0.020
	[0.180]	[0.193]	[0.183]	[0.178]	[0.184]	[0.166]
father's education	0.056	-0.024	0.071	0.073	0.050	0.064
	[0.171]	[0.178]	[0.177]	[0.165]	[0.170]	[0.178]
Constant	-1.433	-6.004	-1.385	1.909	-1.226	0.548
	[5.480]	[7.192]	[5.487]	[5.196]	[5.412]	[5.550]
Observations	211	211	211	211	211	170
Pseudo R^2	0.4508	0.4658	0.4654	0.4173	0.4542	0.3787
Log L	-33.7865	-32.8606	-32.8855	-35.8478	-33.5745	-32.9501

Table C.3: Full regression results: Determinants of Smoking

	Model I	Model II	Model III	Model IV	Model V	Model VI
CRT score	0.033	0.111	0.037	0.037	0.033	-0.005
	[0.119]	[0.123]	[0.118]	[0.118]	[0.120]	[0.122]
IQ score	0.004		0.004	0.004	0.004	0.004
	[0.006]		[0.006]	[0.006]	[0.006]	[0.006]
Grade German		-0.441				
		[0.286]				
Grade English		-0.013				
		[0.188]				
Grade Math		-0.395**				
		[0.176]				
Grit score	-0.266	-0.240	-0.015	-0.068	-0.410**	-0.357
	[0.227]	[0.234]	[0.144]	[0.193]	[0.171]	[0.229]
1 = risk averse	-0.454*	-0.463*	-0.486*	-0.483*	-0.434*	
	[0.254]	[0.260]	[0.252]	[0.252]	[0.256]	
1 = risk loving	-0.336	-0.409	-0.353	-0.353	-0.315	
	[0.254]	[0.260]	[0.253]	[0.253]	[0.257]	
γ						-0.082
(coeff. of risk aversion)						[0.106]
Discounting switchpoint	0.004	0.007	0.004	0.004	0.004	0.004
	[0.005]	[0.006]	[0.005]	[0.005]	[0.005]	[0.005]
Big Five:	-0.002	0.003	-0.006	-0.004	0.003	-0.001
Openness	[0.012]	[0.012]	[0.011]	[0.012]	[0.012]	[0.012]
Big Five:	-0.011	-0.009	-0.013	-0.012	-0.008	-0.016
Conscientiousness	[0.015]	[0.016]	[0.015]	[0.016]	[0.015]	[0.016]
Big Five:	0.025*	0.025*	0.026*	0.026*	0.028*	0.023
Extraversion	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
Big Five:	-0.001	-0.007	0.001	0.001	-0.003	-0.002
Agreeableness	[0.015]	[0.015]	[0.014]	[0.014]	[0.015]	[0.015]
Big Five:	0.017	0.018	0.018	0.019	0.015	0.017
Emotional Stability	[0.015]	[0.016]	[0.015]	[0.015]	[0.016]	[0.015]
parents divorced	0.776***	0.792***	0.772***	0.775***	0.804***	0.743***
	[0.247]	[0.255]	[0.246]	[0.246]	[0.249]	[0.247]
number of siblings	-0.042	-0.050	-0.063	-0.059	-0.046	-0.021
	[0.118]	[0.121]	[0.117]	[0.117]	[0.117]	[0.121]
difficulty of raising 100 CHF	0.062	0.117	0.060	0.062	0.030	0.074
	[0.104]	[0.109]	[0.104]	[0.104]	[0.106]	[0.106]
1 = born in CH	0.410	0.513	0.420	0.407	0.364	0.422
	[0.347]	[0.355]	[0.346]	[0.346]	[0.349]	[0.365]
1 = female	-0.286	-0.164	-0.273	-0.283	-0.373	-0.331
	[0.242]	[0.248]	[0.242]	[0.241]	[0.249]	[0.246]
age	-0.073	-0.095	-0.067	-0.069	-0.079	-0.019
	[0.128]	[0.131]	[0.128]	[0.128]	[0.127]	[0.127]
1 = sekb	0.630**	0.860***	0.642**	0.653**	0.600**	0.690**
	[0.283]	[0.307]	[0.283]	[0.283]	[0.285]	[0.284]
1 = tenthyear	0.358	0.562*	0.340	0.350	0.397	0.327
	[0.277]	[0.293]	[0.276]	[0.277]	[0.279]	[0.284]
1 = other schooling	-0.240	-0.017	-0.313	-0.286	0.024	-0.059
	[0.709]	[0.761]	[0.706]	[0.708]	[0.719]	[0.679]
mother's education	-0.054	-0.035	-0.059	-0.057	-0.054	-0.052
	[0.092]	[0.094]	[0.092]	[0.092]	[0.092]	[0.092]
father's education	0.214**	0.247**	0.218**	0.218**	0.221**	0.228**
	[0.093]	[0.096]	[0.093]	[0.093]	[0.093]	[0.093]
Constant	-0.912	2,717	-1,729	-1,662	-0.354	-1,586
	[3.129]	[3.369]	[3.104]	[3.063]	[3.095]	[3.121]
Observations	218	218	218	218	218	214
Pseudo R^2	0.1600	0.1951	0.1551	0.1555	0.1764	0.1555
Log L	-116.1665	-111.3084	-116.8505	-116.7942	-113.8956	-113.6219

Table C.4: Full regression results: Determinants of Bingeing

	Model I	Model II	Model III	Model IV	Model V	Model VI
CRT score	0.321***	0.377***	0.318***	0.330***	0.318***	0.361***
	[0.116]	[0.120]	[0.116]	[0.116]	[0.116]	[0.122]
IQ score	0.001		0.001	0.001	0.000	0.001
	[0.005]		[0.005]	[0.005]	[0.005]	[0.005]
Grade German		-0.248				
		[0.280]				
Grade English		-0.018				
		[0.181]				
Grade Math		-0.303*				
		[0.182]				
Grit score	-0.360	-0.315	0.002	-0.394**	-0.346**	-0.458**
	[0.226]	[0.229]	[0.141]	[0.197]	[0.175]	[0.228]
1 = risk averse	-0.380	-0.366	-0.412	-0.402	-0.378	
	[0.259]	[0.263]	[0.258]	[0.257]	[0.261]	
1 = risk loving	-0.431*	-0.482*	-0.443*	-0.456*	-0.440*	
	[0.255]	[0.259]	[0.255]	[0.256]	[0.257]	
γ						-0.004
(coeff. of risk aversion)						[0.108]
switchpoint discountin	-0.004	-0.002	-0.004	-0.003	-0.004	-0.004
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Big Five:	0.007	0.010	0.001	0.011	0.009	0.006
Openness	[0.012]	[0.012]	[0.011]	[0.012]	[0.012]	[0.012]
Big Five:	-0.046***	-0.046***	-0.048***	-0.043***	-0.046***	-0.053***
Conscientiousness	[0.016]	[0.017]	[0.016]	[0.017]	[0.017]	[0.017]
Big Five:	-0.015	-0.019	-0.014	-0.013	-0.013	-0.018
Extraversion	[0.014]	[0.015]	[0.014]	[0.015]	[0.015]	[0.015]
Big Five:	-0.031**	-0.037**	-0.026*	-0.031**	-0.033**	-0.031**
Agreeableness	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
Big Five:	0.021	0.022	0.022	0.025	0.021	0.022
Emotional Stability	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
parents divorced	0.311	0.284	0.310	0.328	0.318	0.390
	[0.255]	[0.258]	[0.253]	[0.255]	[0.255]	[0.260]
number of siblings	-0.161	-0.168	-0.187*	-0.155	-0.185	-0.110
	[0.114]	[0.115]	[0.114]	[0.114]	[0.113]	[0.117]
difficulty of raising 100 CHF	0.103	0.138	0.093	0.119	0.083	0.084
	[0.102]	[0.107]	[0.102]	[0.103]	[0.103]	[0.103]
1 = born in CH	0.733**	0.747**	0.725**	0.693**	0.691**	0.714**
	[0.353]	[0.359]	[0.351]	[0.353]	[0.352]	[0.362]
1 = female	-0.255	-0.225	-0.247	-0.284	-0.338	-0.278
	[0.232]	[0.236]	[0.232]	[0.232]	[0.239]	[0.233]
age	0.048	0.034	0.051	0.048	0.049	0.073
	[0.124]	[0.128]	[0.123]	[0.123]	[0.126]	[0.125]
1 = sekb	0.132	0.261	0.161	0.195	0.094	0.294
	[0.275]	[0.285]	[0.275]	[0.275]	[0.275]	[0.279]
1 = tenthyear	0.118	0.246	0.102	0.149	0.124	0.118
	[0.275]	[0.287]	[0.274]	[0.276]	[0.276]	[0.280]
1 = other schooling	0.449	0.592	0.363	0.516	0.587	0.600
	[0.670]	[0.687]	[0.665]	[0.690]	[0.673]	[0.655]
mother's education	0.091	0.118	0.092	0.097	0.093	0.088
	[0.093]	[0.094]	[0.093]	[0.094]	[0.094]	[0.093]
father's education	0.224**	0.235**	0.225**	0.224**	0.233**	0.217**
	[0.093]	[0.094]	[0.092]	[0.093]	[0.093]	[0.093]
Constant	3,025	5.773*	1,908	2,499	3,212	3,047
	[3.070]	[3.412]	[3.024]	[2.991]	[3.084]	[3.095]
Observations	218	218	218	218	218	214
Pseudo R^2	0.1786	0.1950	0.1700	0.1837	0.1834	0.1802
Log L	-123.2077	-120.7514	-124.4898	-122.4338	-122.4806	-120.6818

C.3 Instructions for Experimental Sessions

The following pages contain the original questionnaires and instructions for the experimental sessions in vocational schools. Part 1 is a background questionnaire on subjects' schooling career, family, friends, risky behaviors and leisure time activities. It is followed by the Grit score inventory in German translation, the Big 5 - 15 item short version used in the German Socio-Economic Panel, and the Cognitive Reflection Test. Part 2 contains the Symbol Correspondence Test from the German language version of the Wechsler Adult Intelligence Scale (WAIS), which is known as the "Hamburg-Wechsler Intelligenztest für Erwachsene" (HAWIE-R). Finally, Part 3 contains the choice questions that we used in order to elicit individuals' risk attitude, loss aversion, and time preference.

ID-NR.:_____

Studienteil 1

Bitte beantworten Sie die folgenden Fragen zu Schulbildung, Freundeskreis, Freizeitverhalten und Familie. Bei den meisten Fragen genügt es, die Antworten anzukreuzen. **Bitte antworten Sie offen und ehrlich – die Befragung ist komplett anonym.** Weder Eltern noch Lehrer erfahren von ihren persönlichen Ergebnissen.
Für die Teilnahme an der Studie erhält jeder von Ihnen ein Startgeld von 10 CHF. In späteren Studienteilen können Sie weiteres Geld hinzuverdienen.

Vielen Dank für Ihre Unterstützung!

Fragen zur Schulbildung:

Welche Schule haben Sie unmittelbar vor Beginn Ihrer Lehre abgeschlossen?

- o Sekundarschule
  - ● Sekundarschule A □
  - ● Sekundarschule B □
  - ● Sekundarschule C □
  - ● Stammklasse E □
  - ● Stammklasse G □
- o Ein Brückenangebot, nämlich:
  - ● 10. Schuljahr □
  - ● Berufswahlschule □
  - ● Werkjahr □
  - ● Anderes, nämlich:_____
- o Gymnasium/Maturität □
- o Sonderschule □
- o Anderes, nämlich:

Unterscheidet sich Ihr höchster Schulabschluss hiervon?

Ja □ Nein □

Falls Ja, was ist Ihr höchster Schulabschluss? _____

Welche Noten hatten Sie in Ihrem höchsten Schulabschlusszeugnis in den folgenden Fächern?

Deutsch: _____
Mathematik: _____
Englisch: _____

Wie viele Bewerbungen haben Sie für Ihre Lehrstelle geschrieben?_____

Wie sicher sind Sie, dass Sie Ihre Lehre abschliessen werden?

sehr sicher	ziemlich sicher	unentschieden	eher unsicher	sehr unsicher
□	□	□	□	□

Haben Sie während Ihrer Schulzeit ein Schuljahr wiederholt?
Ja □ Nein □

Haben Sie den Kindergarten besucht?
Ja □ Nein □ **Falls ja, wie lange?**_____ Jahre

Fragen zum Freundeskreis:

Wie viele Freunde bzw. Freundinnen haben Sie?
Bis zu 10 □
10 bis 20 □
Mehr als 20 □

Was machen Ihre 5 besten Kolleginnen oder Kollegen zurzeit?

Tätigkeit	**Anzahl**
In der Lehre	_____
In der Schule	_____
Arbeiten nach abgeschlossener Lehre	_____
Arbeiten ungelernt	_____
Arbeitslos	_____
Anderes, nämlich:_____	_____

Fragen zum Freizeitverhalten:

Welche Hobbys betreiben Sie? _____

Wie viele Stunden verwenden Sie wöchentlich für Ihre Hobbies? _____ Stunden

Rauchen Sie?
Ja □ Nein □

Falls ja, seit wie vielen Jahren rauchen Sie? Seit _____ Jahren

Falls ja, wie viel rauchen Sie?
Selten: ca.1x pro Monat □
Gelegentlich: ca. 1x pro Woche □
Täglich bis 5 Zigaretten □
Täglich 5-10 Zigaretten □
Täglich 10-20 Zigaretten □
Täglich mehr als 20 Zigaretten □

Trinken Sie Alkohol?

Ja □ Nein □

Falls ja, seit wie vielen Jahren trinken Sie Alkohol? Seit _____ Jahren

Falls ja, wie oft trinken Sie Alkohol?

Selten: ca.1x pro Monat oder seltener □
Gelegentlich: ca. 1x pro Woche □
Mehrmals pro Woche □
Täglich □

Falls ja, wie oft haben Sie im letzten Jahr 8 Gläser (Männer) bzw. 6 Gläser (Frauen) Bier, Wein, Schnaps oder anderen Alkohol bei derselben Gelegenheit getrunken?

Nie □
Selten: ca. 1x pro Monat oder seltener □
Gelegentlich: ca. 1x pro Woche □
Jeden Tag oder fast jeden Tag □

Fragen zur Familie:

Welches ist der höchste Bildungsabschluss, den Ihre Eltern erworben haben?

	Mutter:	**Vater:**
Kein Schulabschluss	□	□
Obligatorische Schule	□	□
Berufsausbildung	□	□
Höhere Berufsprüfung (z.B. Meister)	□	□
Fachschule	□	□
Maturität	□	□
Hochschule	□	□
Anderes, nämlich:	_____	_____

Gehen Ihre Eltern einem regelmässigen Job nach (angestellt oder selbstständig)?

Mutter: Ja □ Nein □

Vater: Ja □ Nein □

Leben Ihre leiblichen Eltern getrennt?

Ja □ Nein □

Falls ja, seit wie vielen Jahren leben sie getrennt? Seit _____ Jahren

Welche Sprache sprechen Sie mit Ihren Eltern?

Deutsch □
Französisch □
Italienisch □
Anderes, nämlich:_____

Wie viele Geschwister haben Sie? _____ Geschwister

Als wievieltes Kind wurden Sie geboren? Als _____ Kind

Wo wohnen Sie zur Zeit?

Zu Hause bei den Eltern □
Gemeinsame Wohnung mit Freund/Freundin □
Bei Verwandten □
In einer Wohngemeinschaft □
Lehrlingswohnheim □
Anderes, nämlich:_____

Wie schwierig ist es für Sie, spontan 100 CHF aufzubringen?

sehr schwierig				Sehr leicht
1	2	3	4	5
O	O	O	O	O

Fragen zu Ihnen:

In welchem Jahr sind Sie geboren? 19__

Und in welchem Monat? _____

In welchem Land sind Sie geboren?

Schweiz □ Anderes, nämlich:_____

Falls Sie nicht in der Schweiz geboren sind, seit wie vielen Jahren leben Sie in der Schweiz?

Seit _____ Jahren

Ihr Geschlecht?

Männlich □ Weiblich □

Wie lautet die Postleitzahl Ihres Wohnortes? _____

Bitte kreuzen Sie bei den folgenden Aussagen an, wie sehr diese auf Sie zutreffen.
Bitte beantworten Sie die Fragen ehrlich – es gibt keine richtigen oder falschen Antworten! Wahrscheinlich werden einige Aussagen auf Sie persönlich voll zutreffen und andere überhaupt nicht. Bei wieder anderen sind Sie vielleicht eher unentschieden. Kreuzen Sie bitte so an, wie es auf Sie persönlich zutrifft.

	Trifft gar nicht auf mich zu				**Trifft voll auf mich zu**
Bei allem, was ich mache, will ich der oder die Beste sein.	☐	☐	☐	☐	☐
Ich habe Rückschläge überwunden, um eine wichtige Herausforderung zu bewältigen.	☐	☐	☐	☐	☐
Neue Ideen und Projekte lenken mich manchmal von alten Ideen und Projekten ab.	☐	☐	☐	☐	☐
Ich bin ehrgeizig.	☐	☐	☐	☐	☐
Meine Interessen ändern sich von Jahr zu Jahr.	☐	☐	☐	☐	☐
Rückschläge entmutigen mich nicht.	☐	☐	☐	☐	☐
Ich war kurzfristig von einer Idee oder einem Projekt besessen, habe aber später das Interesse daran verloren.	☐	☐	☐	☐	☐
Ich arbeite hart.	☐	☐	☐	☐	☐
Ich setze mir oft ein Ziel und beschließe dann später, ein anderes Ziel zu verfolgen.	☐	☐	☐	☐	☐
Ich habe Schwierigkeiten, mich auf Projekte zu konzentrieren, die länger als ein paar Monate bis zum Abschluss benötigen.	☐	☐	☐	☐	☐
Ich bringe zu Ende, was auch immer ich angefangen habe.	☐	☐	☐	☐	☐
Es ist das höchste Ziel im Leben, etwas von bleibender Bedeutung zu erreichen.	☐	☐	☐	☐	☐
Ich denke, dass Erfolg überbewertet wird.	☐	☐	☐	☐	☐
Ich habe schon einmal ein Ziel erreicht, das jahrelange Arbeit erfordert hat.	☐	☐	☐	☐	☐
Ich bin von Erfolgswillen getrieben.	☐	☐	☐	☐	☐
Ich interessiere mich alle paar Monate für neue Ziele.	☐	☐	☐	☐	☐
Ich bin fleissig.	☐	☐	☐	☐	☐

Hier sind wieder unterschiedliche Eigenschaften aufgeführt, die eine Person haben kann.
Bitte kreuzen Sie bei jeder Aussage an, wie sehr diese auf Sie zutrifft.

Ich bin jemand, der …	**Trifft überhaupt nicht zu**						**Trifft voll zu**
gründlich arbeitet.	☐	☐	☐	☐	☐	☐	☐
kommunikativ, gesprächig ist.	☐	☐	☐	☐	☐	☐	☐
manchmal etwas grob zu anderen ist.	☐	☐	☐	☐	☐	☐	☐
originell ist, neue Ideen einbringt.	☐	☐	☐	☐	☐	☐	☐
sich oft Sorgen macht.	☐	☐	☐	☐	☐	☐	☐
eher faul ist.	☐	☐	☐	☐	☐	☐	☐
aus sich herausgehen kann, gesellig ist.	☐	☐	☐	☐	☐	☐	☐
künstlerische, ästhetische Erfahrungen schätzt.	☐	☐	☐	☐	☐	☐	☐
leicht nervös wird.	☐	☐	☐	☐	☐	☐	☐
Aufgaben wirksam und effizient erledigt.	☐	☐	☐	☐	☐	☐	☐
zurückhaltend ist.	☐	☐	☐	☐	☐	☐	☐
rücksichtsvoll und freundlich mit anderen umgeht.	☐	☐	☐	☐	☐	☐	☐
eine lebhafte Phantasie, Vorstellungen hat.	☐	☐	☐	☐	☐	☐	☐
entspannt ist, mit Stress gut umgehen kann.	☐	☐	☐	☐	☐	☐	☐
wissbegierig ist.	☐	☐	☐	☐	☐	☐	☐

Bitte beantworten Sie die folgenden drei Fragen:

i. Ein Hockeyschläger und ein Puck kosten zusammen 11 CHF. Der Schläger kostet 10 CHF mehr als der Puck. Wieviel CHF kostet der Puck? ___

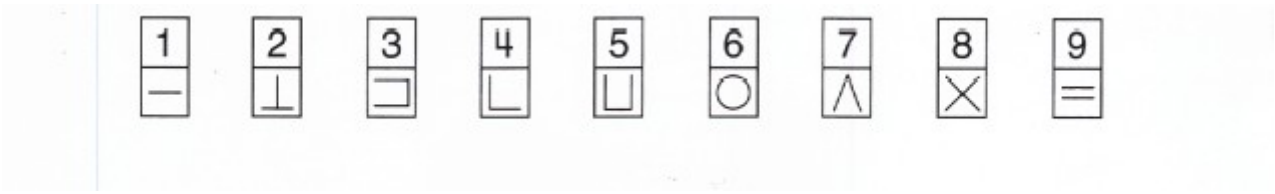
ii. Wenn 5 Maschinen 5 Minuten brauchen, um 5 Teile herzustellen, wie lange brauchen dann 100 Maschinen, um 100 Teile herzustellen? ___

iii. Auf einem Teich gibt es einen Seerosen-Teppich. Jeden Tag verdoppelt der Teppich seine Grösse. Wenn es 48 Tage braucht, bis der Teppich den ganzen Teich bedeckt, wie lange dauert es dann, bis er den halben Teich bedeckt? ___

Danke für Ihre Mitarbeit. Bitte wenden Sie sich nun an den Studienleiter. Sobald alle Teilnehmer den Fragebogen komplett ausgefüllt haben, beginnt der zweite Teil der Studie.

ID-NR.:_____

Studienteil 2



2	1	3	2	1	4	2	3	5	2	3	1	4

5	6	3	1	4	1	5	4	2	7	6	3	5	7	2	8	5	4	6	3

7	2	8	1	9	5	8	4	7	3	6	2	5	1	9	2	8	3	7	4

6	5	9	4	8	3	7	2	6	1	5	4	6	3	7	9	2	8	1	7

9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

2	7	3	6	5	1	9	8	4	5	7	3	1	4	8	7	9	1	4	5

7	1	8	2	9	3	6	7	2	8	5	2	3	1	4	8	4	2	7	6

ID-NR.:_____

Studienteil 3

In diesem letzten Teil der Studie werden Sie Entscheidungen treffen, bei denen Sie zu Ihrem Startgeld von 10 CHF weiteres Geld hinzu verdienen können. Lesen Sie also die Ausführungen und Erklärungen sorgfältig durch, um informierte Entscheidungen treffen zu können. Bei Fragen zu den Entscheidungssituationen oder zum Ausfüllen der Entscheidungsbögen können Sie sich jederzeit an die Studienleiter wenden.

Wichtig:
Bei diesem Teil der Studie gibt es keine richtigen oder falschen Antworten. Für uns ist es nur wichtig, dass Sie Ihre Entscheidungen vollständig und sorgfältig treffen.

Es ist weiterhin sehr wichtig, dass Sie Ihre Entscheidungen alleine treffen und sich nicht mit Ihrem Sitznachbarn absprechen.

Entscheidungssituation 1:

Zunächst müssen Sie sich entscheiden, ob Sie lieber einen sicheren Geldbetrag erhalten möchten, oder ob Sie eine Münze werfen möchten, bei der Sie bei „Kopf“ 10 CHF erhalten und bei „Zahl“ nichts erhalten.

In der untenstehenden Tabelle sind mehrere Entscheidungen zwischen dem Münzwurf und verschiedenen sicheren Auszahlungen aufgeführt. Beim Münzwurf können Sie jeweils bei „Kopf“ 10 CHF verdienen. Wieviel Sie anstelle des Münzwurfs als sichere Auszahlung angeboten bekommen, variiert jedoch von Entscheidung zu Entscheidung.

Bitte treffen Sie in der untenstehenden Tabelle in jeder Zeile eine Entscheidung darüber, ob Sie den Münzwurf oder lieber den sicheren Geldbetrag annehmen wollen.

Am Ende der Studie wird eine Zeile zufällig ausgelost. Entsprechend Ihrer Entscheidung in dieser Zeile erhalten Sie entweder die sichere Auszahlung, oder es wird die Münze geworfen und Sie erhalten abhängig vom Ergebnis entweder 10 oder 0 CHF.

Beispiele zum Ausfüllen:

1. Angenommen, Sie kreuzen in den Zeilen 1 bis 8 den Münzwurf an und in den Zeilen 9 und 10 die sichere Auszahlung. Dies bedeutet, dass Sie 9 resp. 10 CHF für sicher lieber haben als den Münzwurf, bei dem Sie bei „Kopf“ 10 CHF gewinnen könnten. Sobald Ihnen allerdings 8 CHF oder weniger anstelle des Münzwurfs geboten werden, nehmen Sie lieber den Münzwurf.

2. Angenommen Sie kreuzen nur in Zeile 1 und 2 an, dass Sie den Münzwurf annehmen, und in den Zeilen 3 bis 10 die sichere Auszahlung. Dies bedeutet, dass Sie ab einem sicheren Betrag von 3 CHF auf den Münzwurf verzichten, bei dem Sie 10 CHF gewinnen könnten.

Bitte treffen Sie in jeder Zeile der Tabelle eine Entscheidung.

	Münzwurf: Kopf = 10 CHF, Zahl = 0 CHF	*Sichere Auszahlung von X CHF*
1.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 1 CHF.
2.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 2 CHF.
3	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 3 CHF.
4.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 4 CHF.
5.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 5 CHF.
6.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 6 CHF.
7.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 7 CHF.
8.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 8 CHF.
9.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 9 CHF.
10.	□ Ich nehme den Münzwurf an.	□ Ich möchte eine sichere Auszahlung von 10 CHF.

<u>Entscheidungssituation 2:</u>

Sie müssen sich wiederum entscheiden, ob Sie einen Münzwurf annehmen möchten oder nicht. **Dieses Mal können Sie jedoch beim Münzwurf Geld gewinnen oder verlieren**. **Eventuelle Verluste müssen Sie durch das von uns zur Verfügung gestellte Startkapital (10 CHF) ausgleichen. Falls Sie den Münzwurf nicht annehmen, passiert in diesem Studienteil nichts weiter, Sie gewinnen kein Geld und Sie verlieren kein Geld.**

Falls Sie sich für den Münzwurf entscheiden, wirft der Studienleiter am Ende der Studie eine Münze, und je nach Ausgang des Wurfs sind die Auszahlungen an Sie wie folgt:

- Kopf: Sie erhalten 6 CHF
- Zahl: Sie verlieren X CHF

Der Betrag, den Sie bei „Zahl“ potentiell verlieren können, variiert von Zeile zu Zeile. **Bitte treffen Sie in der untenstehenden Tabelle in jeder Zeile eine Entscheidung, ob sie den Münzwurf annehmen möchten, oder lieber nicht am Münzwurf teilnehmen möchten.** Wenn Sie den Münzwurf annehmen, und es fällt „Kopf“, so erhalten Sie 6 CHF. Wenn „Zahl“ fällt, so wird Ihnen am Ende der Studie der entsprechende Betrag von Ihrem Gesamteinkommen abgezogen.

Am Ende der Studie wird wiederum eine Zeile zufällig ausgelost, und entsprechend Ihrer Entscheidung in dieser Zeile passiert entweder nichts, oder es wird die Münze geworfen.

Bitte treffen Sie in jeder Zeile der Tabelle eine Entscheidung:

		*Ich **lehne** den Münzwurf **ab.***	*Ich **nehme** den Münzwurf **an.***
1.	Wenn die Münze Zahl zeigt, **verlieren Sie 2 CHF.** Wenn die Münze Kopf zeigt, **gewinnen Sie 6 CHF.**	□	□
2.	Wenn die Münze Zahl zeigt, **verlieren Sie 3 CHF.** Wenn die Münze Kopf zeigt, **gewinnen Sie 6 CHF.**	□	□
3	Wenn die Münze Zahl zeigt, **verlieren Sie 4 CHF.** Wenn die Münze Kopf zeigt, **gewinnen Sie 6 CHF.**	□	□
4.	Wenn die Münze Zahl zeigt, **verlieren Sie 5 CHF.** Wenn die Münze Kopf zeigt, **gewinnen Sie 6 CHF.**	□	□
5.	Wenn die Münze Zahl zeigt, **verlieren Sie 6 CHF.** Wenn die Münze Kopf zeigt, **gewinnen Sie 6 CHF.**	□	□
6.	Wenn die Münze Zahl zeigt, **verlieren Sie 7 CHF.** Wenn die Münze Kopf zeigt, **gewinnen Sie 6 CHF.**	□	□

Entscheidungssituation 3:

In dieser Entscheidungssituation müssen Sie sich zwischen zwei Geldbeträgen (Option A und Option B) entscheiden, die Sie zu unterschiedlichen Zeitpunkten erhalten können.

- Eine frühe Option A: Wenn Sie sich für diese Möglichkeit entscheiden, erhalten Sie einen bestimmten Betrag **heute**.
- Eine spätere Option B: Sie erhalten in **3 Monaten** 100 CHF von uns ausbezahlt. Hierfür erhalten Sie heute ein Garantieschreiben der Universität, dass Ihnen der entsprechende Geldbetrag in drei Monaten bar per Einschreiben zugestellt wird.

In der folgenden Tabelle sind mehrere Entscheidungen zwischen diesen beiden Optionen aufgeführt. Eine Alternative ist jeweils die frühe Option A, die andere Alternative ist die spätere Option B.

Am Ende der Studie wird wiederum ausgelost, welche Zeile der Tabelle für Ihre Auszahlung relevant ist. Sollte Ihre ID Nummer für diese Entscheidungssituation gezogen worden sein, so wird Ihnen der in dieser Zeile gewählte Betrag zum angegebenen Zeitpunkt ausbezahlt.

Entscheiden Sie bitte in jeder Reihe, ob Sie die frühe Option A wählen möchten, oder die spätere Option B:

	Option A	*Option B*
1.	□ 5 CHF heute	□ 100 CHF in 3 Monaten
2.	□ 10 CHF heute	□ 100 CHF in 3 Monaten
3.	□ 15 CHF heute	□ 100 CHF in 3 Monaten
4.	□ 20 CHF heute	□ 100 CHF in 3 Monaten
5.	□ 25 CHF heute	□ 100 CHF in 3 Monaten
6.	□ 30 CHF heute	□ 100 CHF in 3 Monaten
7.	□ 35 CHF heute	□ 100 CHF in 3 Monaten
8.	□ 40 CHF heute	□ 100 CHF in 3 Monaten
9.	□ 45 CHF heute	□ 100 CHF in 3 Monaten
10.	□ 50 CHF heute	□ 100 CHF in 3 Monaten
11.	□ 55 CHF heute	□ 100 CHF in 3 Monaten
12.	□ 60 CHF heute	□ 100 CHF in 3 Monaten
13.	□ 65 CHF heute	□ 100 CHF in 3 Monaten
14.	□ 70 CHF heute	□ 100 CHF in 3 Monaten
15.	□ 75 CHF heute	□ 100 CHF in 3 Monaten
16.	□ 80 CHF heute	□ 100 CHF in 3 Monaten
17.	□ 85 CHF heute	□ 100 CHF in 3 Monaten
18.	□ 90 CHF heute	□ 100 CHF in 3 Monaten
19.	□ 95 CHF heute	□ 100 CHF in 3 Monaten
20.	□ 100 CHF heute	□ 100 CHF in 3 Monaten

Entscheidungssituation 4:

Nun haben Sie wiederum die Wahl zwischen zwei Geldbeträgen, die Sie zu zwei unterschiedlichen Zeitpunkten erhalten können:

- Eine frühe Option A: Wenn Sie sich für diese Möglichkeit entscheiden, erhalten Sie einen bestimmten Betrag **in drei Monaten**. Sie erhalten hierfür ein Garantieschreiben der Universität, dass Ihnen der entsprechende Geldbetrag in drei Monaten bar per Einschreiben zugestellt wird.

- Eine spätere Option B: Sie erhalten in **6 Monaten** 100 CHF von uns ausbezahlt. Sie erhalten hierfür ein Garantieschreiben der Universität, dass Ihnen der entsprechende Geldbetrag in sechs Monaten bar per Einschreiben zugestellt wird.

Am Ende der Studie wird wiederum ausgelost, welche Zeile der Tabelle für Ihre Auszahlung relevant ist. Sollte Ihre ID Nummer für diese Entscheidungssituation gezogen worden sein, so wird Ihnen der in dieser Zeile gewählte Betrag zum angegebenen Zeitpunkt ausbezahlt.

Entscheiden Sie bitte in jeder Reihe, ob Sie die frühe Option A oder die spätere Option B wählen möchten:

	Option A	*Option B*
1.	□ 5 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
2.	□ 10 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
3.	□ 15 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
4.	□ 20 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
5.	□ 25 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
6.	□ 30 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
7.	□ 35 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
8.	□ 40 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
9.	□ 45 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
10.	□ 50 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
11.	□ 55 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
12.	□ 60 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
13.	□ 65 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
14.	□ 70 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
15.	□ 75 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
16.	□ 80 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
17.	□ 85 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
18.	□ 90 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
19.	□ 95 CHF in 3 Monaten	□ 100 CHF in 6 Monaten
20.	□ 100 CHF in 3 Monaten	□ 100 CHF in 6 Monaten

Curriculum Vitae: Donata Bessey

Personal Details

Citizenship	German
Date of Birth	April 16, 1979

Education

07/08 - 06/09	Visiting Student Researcher at UC Berkeley, Institute for Research on Labor and Employment
04/06 - 02/10	Doctoral student at the University of Zurich, completion of the "Course Programme for Doctoral Students in Economics of Education" in May 2007
10/05 - 12/05	Doctoral student at the University of Mannheim (CDSEM)
10/00 - 06/05	Undergraduate studies in Economics with Latin American Studies at the Universities of Tübingen and Lausanne Degree: *Diplom-Volkswirtin*
10/99 - 09/00	Undergraduate studies in Romance Languages (major), Political Science and Business Economics (minors) at the University of Tübingen

Publications and Working Papers

International Student Migration to Germany. Empirical Economics, forthcoming.
With U. Backes-Gellner, K. Pull and S. Tuor: What Behavioural Economics Teaches Personnel Economics. Swiss Journal of Business Research and Practice (Die Unternehmung), 3/2008.
Starting Salaries of Swiss Economics Graduates: The "Röstigraben" and Other Determinants, "Analyses et Prévisions" of the "Institut Créa de macroéconomie appliquée ", Université de Lausanne, Spring 2004.
Premature Apprenticeship Terminations: An Economic Analysis. ISU Economics of Education Working Paper Series #2
Dropping out and revising educational decisions: Evidence from vocational education. ISU Economics of Education Working Paper Series #40
Marijuana Consumption, Educational Outcomes and Labor Market Success: Evidence from Switzerland. ISU Economics of Education Working Paper Series #43

Employment Record

04/06 - 02/10	Research Assistant at the University of Zurich, Chair for Business and Personnel Economics, Prof. Dr. U. Backes-Gellner
02/06 - 03/06	Visiting Researcher at the Institute for a Better Demographic Future, Oberursel
10/04 - 02/05	Teaching Assistant for the lecture "Introduction to Business Economics" at the University of Tübingen, Chair of Banking, Prof. Dr. W. Neus
06/04 - 09/05	Student Assistant at the University of Tübingen, Chair for Economic Theory (International Finance and Macroeconomics), Prof. Dr. C. M. Buch
03/04	Research Intern at the "Institut Créa de macroéconomie appliquée" (Institute for Applied Macroeconomics), University of Lausanne
08/03 - 11/04	Student Assistant at the Institute for Applied Economic Research (IAW) Tübingen, research area: labor markets and social security
03/02 - 09/02	Student Assistant at the Institute for Applied Economic Research (IAW) Tübingen, research area: international integration and regional development

September 15, 2010